VOL. XV. No. 2 FEBRUARY 1930

MECCANO MAGAZINE

BURROWING UNDER THE HUDSON

(see page 90)

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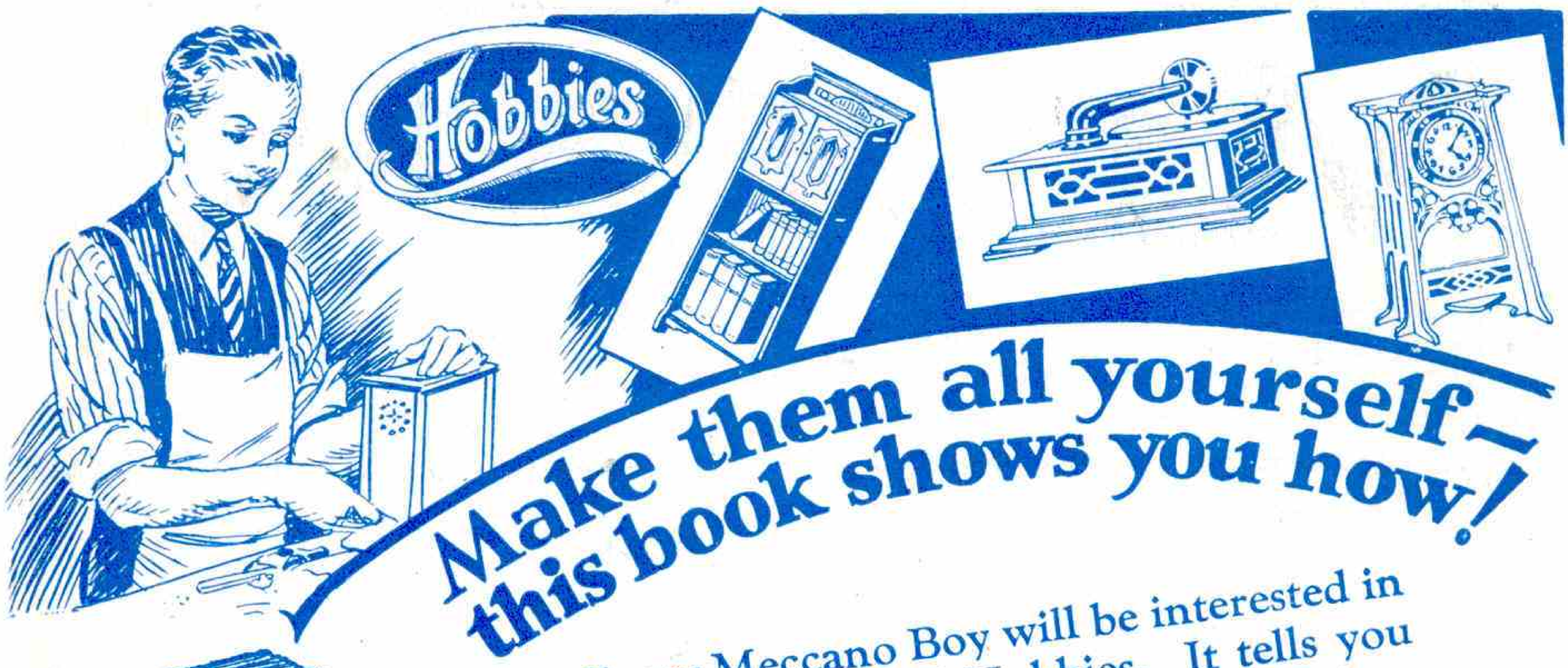

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MECCANO MAGAZINE

Editorial Office:
Binns Road
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Vol. XV. No. 2
February, 1930

With the Editor

Passing of a Famous Engineer

The death of Dr. de Ferranti, which occurred at Zurich on 14th January last, closes the career of one of the most famous of British engineers. My readers will remember that in the "*M.M.*" for December, 1929, we published his portrait in the series of portraits of famous engineers that are being reproduced in connection with the articles on careers for boys.

The story of de Ferranti's life recalls those of such engineers as Brunel and Bright. Like them he was a pioneer in a new branch of engineering and he became famous while practically only a boy. His career began at a time when electric light was practically unknown and the use of electric power on a large scale was a mere dream of the future. To-day the civilised world is rapidly becoming electrified. We have a long way to go before coal is burned only in electric generating stations, but many engineers look forward to the time when this will be the case, and all-electric houses and factories will be the rule.

This was foreseen by de Ferranti nearly 20 years ago. He was then President of the Institution of Electrical Engineers, and in an address to the members he suggested that the whole of the coal used for heating and power should be converted into electricity in a few central generating stations, and the current produced distributed throughout the country. This is the plan that has been adopted by the Central Electricity Board set up in 1926, and thus the first step towards the realisation of this magnificent idea has already been taken. The credit for having made this possible is very largely due to de Ferranti himself, who showed great ingenuity in devising and making electrical machines that worked efficiently. This was no easy task in the early days of electrical engineering and the story of his pioneer efforts in this direction is full of interest.

Dr. Sebastian Ziani de Ferranti was born in Liverpool on 9th April, 1864, and his interest in electricity appears to have occupied almost the whole of his life. He went to school at Ramsgate, and there he spent most of his time—and all his pocket money—in building a dynamo and setting it to work. He was then only 14 years of age and had no published details of such a machine to guide him, but he succeeded in making one that gave a fair arc light.

In view of de Ferranti's great practical interest in electricity it is not surprising that when the time came for him to seek an occupation, he entered the electrical works of Siemens Bros. Sir William Siemens was then making experiments with electric furnaces, and although he was only 17 years of age de Ferranti was chosen to assist him. In this work he showed great inventive powers and introduced a very interesting device for keeping in motion the molten metal inside an electric furnace. This consisted of a coil of wire, wrapped round the furnace, and through which an electric current was passed. Later the young engineer turned this to account in the construction of an electric meter.

Wonderful Inventive Ability

Perhaps the most remarkable of de Ferranti's many inventions was an alternator that he produced when he was only 18 years of age. This gave five times as much light as other machines of the same size, and its appearance greatly alarmed the manufacturers of the older and inferior types. De Ferranti's alternator effected a complete revolution in the design of machines of this kind, and for one so young was a wonderful achievement.

Another direction in which de Ferranti was a very successful pioneer was in the supply of electric current. In 1886 he became engineer of the London Electric Supply Corporation for which he built a power station at Deptford. There generators designed by himself produced current at 2,300 volts, the pressure being changed to 10,000 volts before transmission to Central London. To-day a pressure of 132,000 volts is regarded as normal, but 40 years ago the use by de Ferranti of current at 10,000 volts was regarded as a dangerous and unjustifiable experiment.

In his work as engineer to the Company the young electrician found it necessary to design most of the plant required and he was continually being compelled to invent means of getting over difficulties. One trouble was the absence of measuring instruments suitable for the high voltages he used. It is said that at one time he measured the voltage of the current transmitted by means of a hundred 100-volt lamps connected in series, the efficiency of his transformers being judged by the brightness of the lamps!

Trouble also was encountered in obtaining cables that would carry current at high pressure. A great improvement in their construction was effected by de Ferranti himself, who first used brown paper impregnated with wax as insulating material. Some of the cables constructed according to his designs remained in use for over 30 years.

De Ferranti also first used cables consisting of concentric mains, the outer conductor being earthed. The youthful inventor was so sure that these were safe that he deliberately broke the Board of Trade Regulations, which forbade their use. Later a demonstration that proved his case was arranged. An assistant held a cold chisel in his bare hand while the insulating tool was driven by a sledge hammer through one of de Ferranti's cables carrying current at 10,000 volts. The chisel short-circuited the main, and the supply was cut off by the burning of the fuse of the machine—but the assistant who held the chisel was unharmed!

De Ferranti left the service of the London Electric Supply Corporation in 1892 to found the now well-known business of Ferranti Ltd. He continued to develop improvements in plant and machinery, specialising in transformers, and achieved a world-wide reputation at the early age of 32. In 1924 he was awarded the Faraday Medal, the greatest honour that can be conferred by the Institution of Electrical Engineers. At that time it was said of him that he had done more than anyone else to start the electrical engineering profession.

No. 15
WHAT EVER IS IT?

Here is the fifteenth puzzle in this series of mystery photographs. To the first reader who identifies exactly this mysterious-looking object, or to the reader who gets nearest, I will send an autographed copy of my new book "Wonders of Engineering."

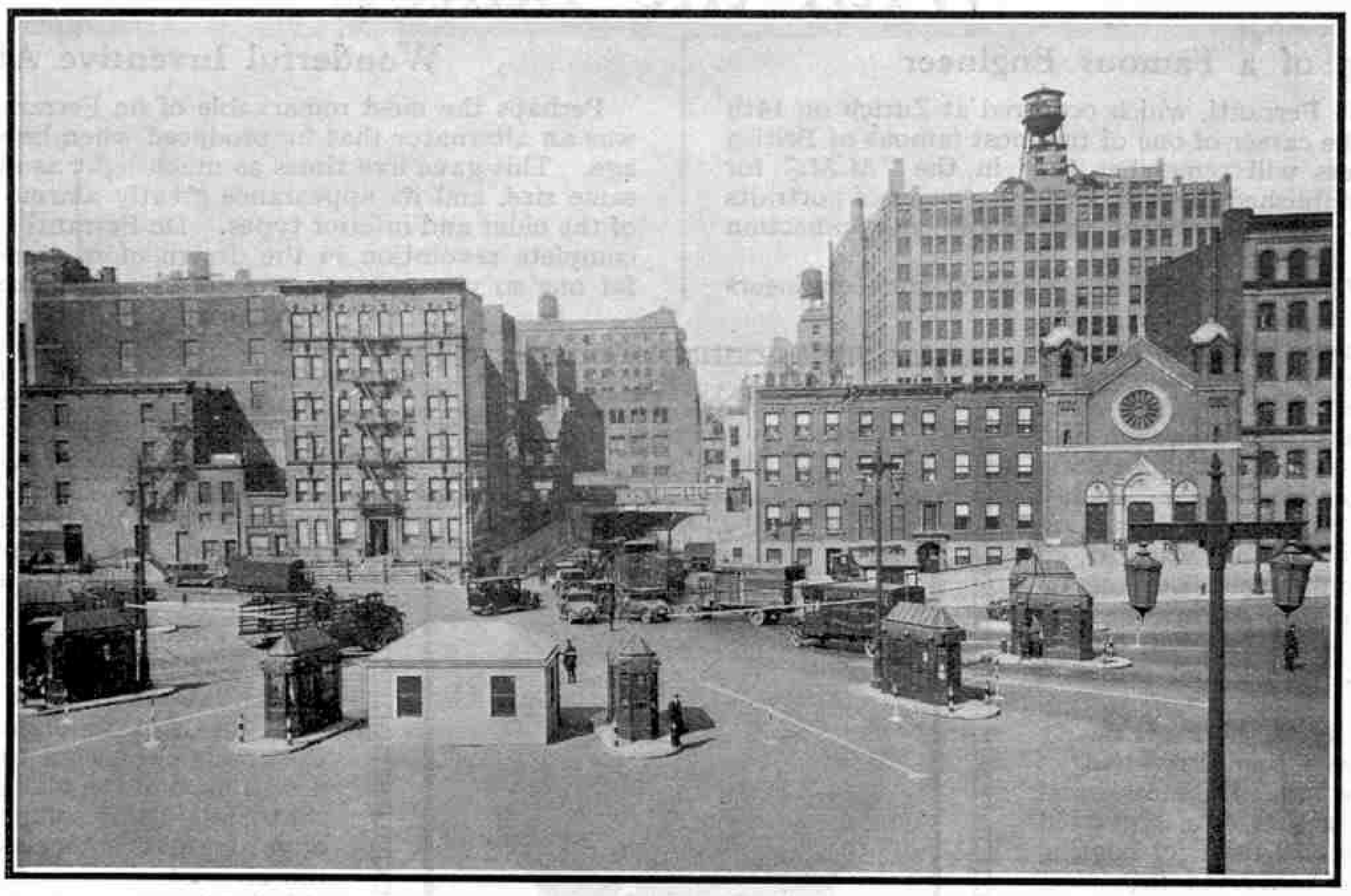
Solutions should be written on postcards only and addressed "Editorial Competition No. 15, Meccano Magazine, Old Swan, Liverpool." Closing date 28th February. For result of Competition No. 14 see page 176.

Burrowing 30 ft. Under the Hudson River

Twin Tunnels Nearly Two Miles in Length

IN the year 1613 a small party of Dutch traders built a few wooden huts at the southern extremity of an island at the mouth of the Hudson River, in the then recently discovered continent of North America. By degrees this small trading settlement grew into a regular colony, which was first the stronghold of the Dutch in America and subsequently fell into the hands of the British, who gave it the name of New York, by which it is still known. From this small beginning more than 300 years ago there has been developed a city that now contains nearly 8,000,000 people.

If the pioneers who founded New York could have foreseen this wonderful growth they certainly would have chosen some other place in which to build their huts, for the modern city is hemmed in on all sides by rivers that have made access to it very difficult. We can scarcely blame these early traders, however, for Manhattan Island on which they built has an area of 22 square miles, and at that period nobody in his wildest moments dreamed that any city in the world would ever cover such a vast space. Still less would it be imagined that some day New York would actually overflow across the three rivers—the Hudson River on the west, and the East and Harlem Rivers to the east and north respectively—that separate it from the mainland. Yet this is the case, and in 1920 only 2,300,000 out of 7,000,000 inhabitants of New York lived on Manhattan Island itself.



Spacious approach to the New York entrance of the north tube of the Holland Tunnel. For permission to reproduce this and the other illustrations to this article, we are indebted to the New York State Bridge and Tunnel Commission.

The rapid growth of this population has necessitated the continuous development of ways and means of crossing from the island to the mainland. All cross-river transport was carried out by ferryboats up to the year 1883 when the first of the world's great suspension bridges was built across the East River to connect New York with Brooklyn. Brooklyn Bridge, as this structure was called, was built under the direction of the famous engineer, J. A. Roebling, who unfortunately died during its erection as the result of an accident.

Since that time other bridges have been constructed in order to cope with the ever-growing traffic between Manhattan Island and other parts of Greater New York, but all of these have been built across either the East River or the Harlem River. The reasons for this choice were twofold. In the first place these rivers are narrower than the Hudson River—which is little short of a mile in width—and therefore the task of bridging them was easier. The second and more important reason was that the Hudson River is a highway for tall-masted ocean-going steamers and any bridge across it necessarily must be at a height of 150 to 180 ft. above high water level in order to give these vessels a clear passage. For the same reason only a single span could be allowed, for a supporting pier in the middle of the river would be too great an obstacle to the busy traffic.

In spite of these difficulties a bridge to span the Hudson River is now being constructed, but this is situated at the north end of Manhattan Island, where the problem of providing approaches is not so serious. A description of this mighty suspension bridge —which will cross the river in a single span of 3,500 ft.—appeared in the May 1928 "*M.M.*" The construction of a similar bridge within a reasonable distance of the business quarter of New York would be a very costly and difficult task. It is not impossible, however, and proposals to build such a structure have already been made.

Apart from the building of a bridge, the obstacle presented by the Hudson River could only be overcome by the construction of a tunnel. The restrictions that hamper the bridge-builder do not apply in the case of an underground roadway. So long as the tunnel keeps below the bed of the river it does not matter how deep it may be, for it cannot interfere in any way with river traffic, or indeed with anything else. In addition there is little difficulty in regard to approaches, for the slopes that lead to the level of the actual tunnel beneath the river bed very quickly disappear underground, and it is not necessary to buy large areas of highly-priced land in the centre of the crowded city in order to construct them.

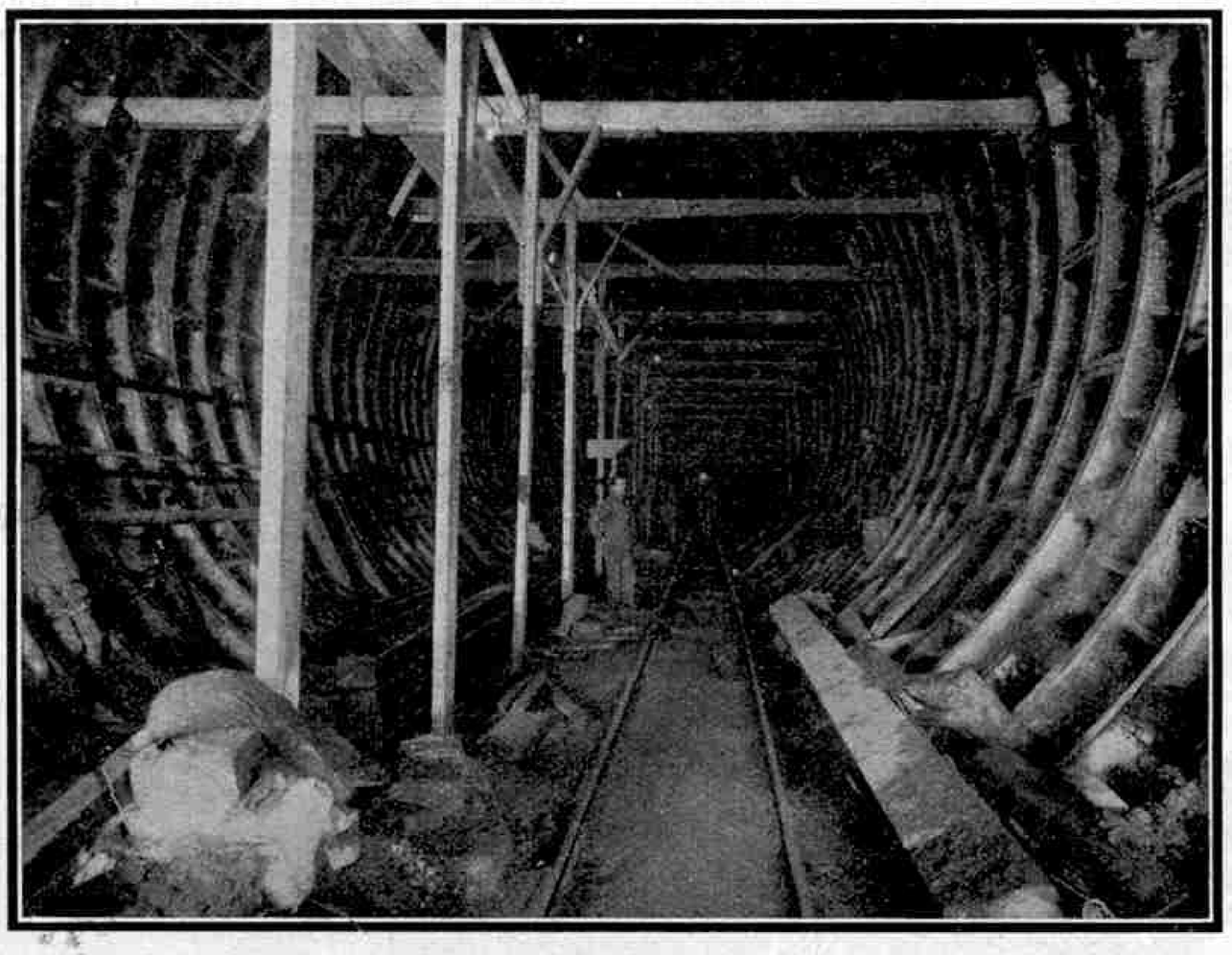
Thus it was that in 1919, when it became absolutely necessary to provide some means of relieving the appalling congestion at the ferries between New York and Jersey City, there was little hesitation in deciding that it should take the form of two tunnels, through each of which traffic should pass in one direction only. The next thing was to find an engineer capable of planning and constructing subways that would be far larger than any previously driven through the mud and clay beneath the bed of a river. Fortunately the very man was at hand in the person of Clifford M. Holland. At the time Holland was only 36 years of age, but he was undoubtedly the most experienced river tunnel engineer in the world. Since leaving college he had been almost entirely occupied in the construction of tunnels beneath the East River, and he was fully acquainted with the nature of the material through which the boring must pass.

Holland soon proved that he possessed the necessary knowledge and skill to construct the enormous tunnels that were necessary, and it is fitting that they should be known by the name of the great engineer who was responsible for planning them. Unfortunately Holland died in 1924 before the underground roadways had been completed. There is little doubt that his death at the early age of 41 was due to the strain and worry associated with his great task, for long hours at a desk and in the atmosphere of compressed air that was maintained within the tunnel itself undermined his health.

Fortunately Holland had shown great judgment in selecting as assistants two men who were well qualified to complete his work. These were Milton H. Freeman and Ole Singstad. Freeman was Holland's immediate successor, but a few months later he

also died, leaving to Singstad the solution of the many new problems that presented themselves as the work progressed. Singstad became the chief engineer in 1925 and to his skill and untiring energy is due the successful conclusion of the enterprise.

Boring under a river is different in many respects from driving a railway tunnel through a mountain range. In the latter case the engineers usually work in hard rock through which they blast their way with dynamite; but a river tunnel usually must be driven through the soft clay and mire of a river bed. At the bottom of the Hudson River, for instance, there is a layer of black mud or silt composed of clay with which a large proportion of fine sand is mixed. Below this is a stratum containing boulders and coarser sand, and it was through material of this kind that Holland was required to drive a tunnel. The water-soaked material is so soft that piles sink into it to a depth of 30 ft. under their own weight, and thus the task exposed the workers to inflows of water from above, while there was always danger of meeting dangerous quicksands.



Interior view of one of the twin tubes of the Holland Tunnel during construction, showing the cast iron ring forming the lining.

In spite of the unpromising nature of such material, methods of working in it have been discovered. The tools of the river tunnel engineer are not drills and dynamite, but compressed air and a gigantic tube with a cutting edge that penetrates through the mud under the impulse given to it by powerful jacks. The tube that cleaves a way through the bed of the river is called the shield, and in its original form was invented by Sir Marc Brunel, the famous engineer who first used one in driving the tunnel beneath the River Thames between Rotherhithe and Wapping.

Improvements in Brunel's shield were subsequently made by Greathead and other engineers who were responsible for the construction of the London tubes. The shields now in use vary according to the nature of the material through which they are required to penetrate, but all act as huge circular cutters. Girders strengthen their sides to prevent distortion by the pressure of the earth, and the front is divided into compartments by uprights and transverse partitions. In these compartments toil the workmen who remove the stiff mud, clay and sand cut out by the shields, a task that in North America has earned for them the name of "sand hogs."

The halfway line! The vertical lines of coloured tiles mark the boundary between the states of New York and New Jersey. This portion of the tunnel is about 16 ft. below the bed of the Hudson River.

The wonderful shields used in driving the Holland Tunnel were of enormous size. One of them was 31 ft. in diameter and was the largest that has ever been used; while the others were only a few inches less. Each one weighed more than 400 tons. Naturally shields of this size and weight could only be constructed in the position from which they were to start on their under-river journey, and they were put together at the bottom of shafts dug on the banks on both sides of the river. Around the edges of each were 30 powerful hydraulic jacks, which gave a total maximum thrust of 6,000 tons. These could be operated either together or separately in groups of five, and under their relentless pressure the shield was forced steadily through the thick clay at an average speed of approximately sixteen feet per day.

At the end of each push workmen entered the pockets or working chambers in the shield in order to remove the spoil, while behind them other men built up the cast iron lining of the actual tunnel. This was assembled in rings, and the jacks that pushed the shield forward were based on the last completed ring. When the spoil had been removed and the cast iron lining carried up to the shield, the jacks again were brought into operation and the shield heaved forward.

Altogether six shields were employed in boring the twin tubes of the Hudson River Tunnel, and little by little they completed the double task of boring from one side of the river to the other. When tunnels are bored from each end, as is usually the case, accuracy of direction becomes very important indeed. It is for this reason that the 30 jacks in each shield were arranged in groups of five, for it was by careful manipulation of the jacks that the shield was steered through the thick clay. If it were required to veer to the left instead of straight ahead, the jacks on the right were extended a little farther than those on the left; similarly, upward movements could be corrected by pushing the shield a little farther at the top. The engineers of the Holland Tunnel carefully determined the direction of the tubes by means of plumb-lines and surveying instruments, and by delicate manipulation of the jacks the various branches were kept in perfect alignment.

We have already explained that one of the greatest enemies of the river tunnel engineer is water, which penetrates into the workings with disastrous results unless special precautions to exclude it are taken. The weapon with which the engineer of to-day fights this danger is compressed air. In excavating the Holland Tunnel concrete bulkheads 10 ft. in thickness were erected in each tube behind the shields, and the intervening space was filled with compressed air. Each of the bulkheads was equipped with locks in which the pressure could be raised to that of the air behind the shield, or lowered to that of the atmosphere. Through these, men and material were passed into or out of the working portion of the tunnel without undue loss of air.

The locks for the workmen fulfilled a double purpose, for they were used to guard against the dreaded caisson disease that the "sand hogs" usually call "bends." This terrible and painful disease is caused by nothing more than tiny bubbles of air! In the blood of men who work under high pressures air dissolves to a greater extent than is the case under ordinary atmospheric pressure. The excess is released when the pressure is lowered, and if this is done too rapidly it comes out in bubbles in exactly the same manner as does the gas in a bottle of ginger ale when the cover is removed.

It is the inert nitrogen in the dissolved air that does the mischief, for the oxygen is used up in chemical changes that take place within the body. The bubbles of nitrogen formed in the blood of a man who is suddenly removed from the atmosphere of

compressed air in a tunnel or caisson interfere with the normal work of the blood, and the pressure of the gas may even have the effect of causing the tissues to become seriously torn.

The disease is very painful, causing its victims to be liable to sudden collapse; and permanent injury or even death may result if the bubbles reach a vital spot. The best method of avoiding injury is to lower the pressure as slowly as possible in order that the gas may be released gradually and without the formation of bubbles. During the construction of the Holland Tunnels this was done in air locks, which were provided with means for altering the pressure slowly from that obtaining in the shield to that of the outside air. The return to ordinary atmospheric conditions was effected at the rate of one minute for each pound of pressure above ten. As a further precaution, the length of the working shift was reduced as the pressure increased until, under the maximum pressure of 47 lb. per sq. in., the men only worked for a period of 45 minutes. In addition each workman was subjected to a rigid medical examination, and a hospital lock with a resident physician and all necessary equipment was provided on each side of the river.

The result of the safety measures adopted was that, with a total number of decompressions, or changes from high to low pressure, of 756,565, only 528 attacks of "bends" or caisson disease were recorded among the workers in the Holland Tunnel, and not one of these was fatal. Yet during the construction of the Pennsylvania Railroad Tunnels under the Hudson River, only 20 years previously, no fewer than 20 men died from the disease, and there were nearly six times as many cases, although 200,000 fewer decompressions were carried out.

It is interesting to note that every tunnel worker was compelled always to wear a badge that gave the addresses at which the special hospital locks were installed. Although every effort was made to protect the men, they were liable to sudden and unexpected collapse, and bystanders were asked to rush to hospital any men wearing the badge who were seen to be ill.

The construction of the Holland Tunnel involved difficulties of many kinds. The actual driving of the tubes through the bed of the river did not exhaust the purely engineering interest, for a large proportion of the tunnel necessarily was below the land on each side of the river, and there several interesting problems were encountered. For instance, it was necessary to deal with a large number of gas mains. Those that were in the track of the tunnel were diverted, the gas being carried through pipes above the traffic on towers, or through similar pipes laid in the gutters. Except where absolutely necessary the old mains were not disturbed, but were relieved of the task of carrying the gas in order to prevent disastrous escapes or explosions if one of them happened to be broken. In addition many buried pipes had to be moved and new positions found for them, and this work involved many delicate operations.

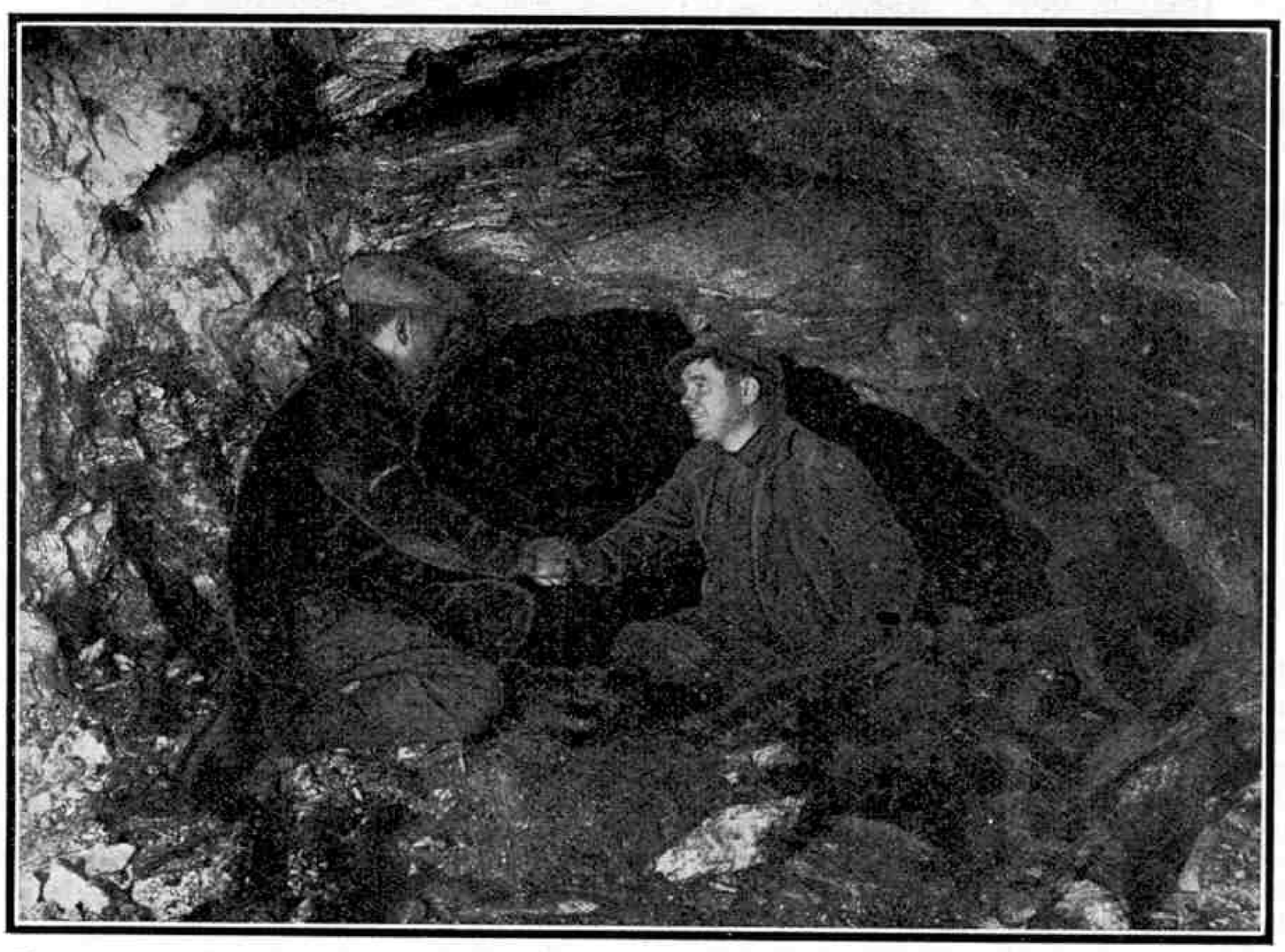
Similar difficulty was encountered in dealing with sewers. At one place the tunnel passed near an old 16 ft. sewer that was only 3 ft. below the surface of the street, and over which passes two tracks of the New York Central Railroad. The sewer was in bad repair and great care had to be taken to avoid damaging it in such a manner that leakage would follow.

Still another source of anxiety arose from the fact that the tunnel passed beneath the foundations of many tall buildings. In every case the utmost care had been taken to avoid disturbance, and this involved providing some means of supporting the weight of the buildings. This was usually done by driving steel piles beneath the foundations. In one interesting case the tunnel excavation was only 10 ft. away from the front of a huge building ten storeys in height. The engineers braced the old wall against the steel sheeting of the tunnel with struts, without causing the slightest disturbance to the old building.

Compressed air was admitted in October, 1922, to the first shield that set out on the slow journey under the river bed, and was removed from the last shield in March, 1925. By this time the shields that had been advancing towards each other had met. Our cover this month shows the scene when this interesting event took place in one of the twin tubes. It also shows how precisely the engineers made their calculations, for it is quite clear that the two shields had been cutting along exactly the same line. The under-river shields still lie in the mud of the bed of the river, for after they had come into contact they were stripped of equipment and abandoned. To-day they form a permanent outside lining to the middle portions of the two tubes. The remaining shields, which had been excavating on shore were dismantled and removed.

When the work was finished two great cast iron tubes lay side by side at depths varying from 16 ft. to 30 ft. below the bed of the river. Their interior walls had been lined with concrete having a minimum thickness of about 14 in. and finished by a covering of white glazed tiles. These tiles were used because they reflect light very well, and by way of ornamentation rows of orange coloured tiles were placed at the top and the bottom. The position in the tunnel of the boundary between the states of New York and New Jersey is marked out by vertical lines of similar tiles.

(*To be continued next month*)



Underground greetings! Tunnel workers shaking hands after "holing through" when the sections bored from opposite sides of the river met.

The New High-Pressure Locomotives—

(*Continued from page 103*)

injector on the fireman's side of the engine, to feed the low-pressure boiler.

As steam is raised much more quickly in the high-pressure drum than in the low-pressure boiler, arrangements are made to by-pass, by means of an intercepting valve, any excess steam from the high-pressure drum into the low-pressure boiler, thus avoiding waste through blowing-off.

The method of working this locomotive is more or less normal. The regulator handle operates both the high-pressure and the low-pressure regulator simultaneously. On opening the regulator steam is admitted into the high-pressure cylinder after passing through the high-pressure superheater situated in the lower boiler tubes. Exhausting from the high-pressure cylinder, the steam enters a mixing chamber, where it is met by low-pressure steam at 250 lb. pressure, which previously has passed through a low-pressure superheater situated in the upper boiler tubes. From the mixing chamber steam enters the two outside cylinders and goes thence to the exhaust.

It will be interesting to see how these two locomotives compare with high-pressure locomotives that have been tried in other countries. In the United States, for instance, the Delaware and Hudson Railroad put into service as far back as 1924 a locomotive with a special water-tube firebox and boiler design and a working steam pressure of 350 lb. to the sq. in. This locomotive gave such good results in heavy freight working that in 1927 another of similar design was introduced with a steam pressure of 400 lb. This engine also appears to have shown very high general efficiency.

An even more remarkable locomotive has been built in Switzerland by the Swiss Locomotive and Machine Company of Winterthur. In this locomotive a pressure of 850 lb. per sq. in. has been boldly adopted, in conjunction with a water-tube boiler of novel design.

New Sixty-Ton Trolleys for L.M.S.

Vehicles to Carry Giant Transformers

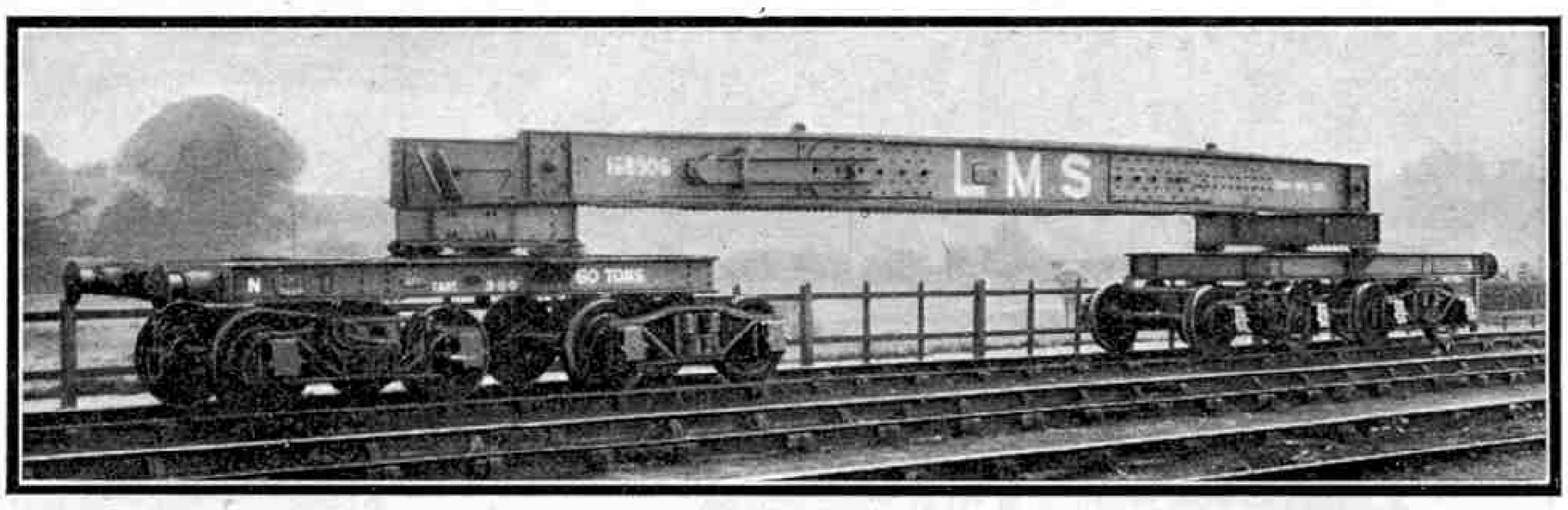
THE L.M.S.R. have recently placed in service two trolleys of an entirely new type, specially designed for the conveyance of large electrical transformers. Their nominal carrying capacity is 60 tons, but the actual capacity is considerably higher. The vehicles are also suitable for carrying heavy rings or other types of load when required.

As in the case of the 80-ton trolleys already in use, there are two 4-wheeled bogies at each end of the wagon, coupled by means of equalising beams. Owing to the use of diamond frame bogies to reduce the tare weight, these beams are extended to carry the buffing and drawgear. Swivelling bolsters carried centrally on the equalising beams are fitted with sliding clutch brackets, engaging similar clutches on the main girder. These clutches ensure a rigid joint, which at the same time is very easily disconnected. The actual weight of the load, plus the beams, rests on the top surfaces of these swivelling bolsters, while all buffing and draw stresses are transmitted through the clutches and sliding brackets.

The transformers are slung between the girders, the weight being carried by means of brackets forming part of the transformer casing, and which rest on the top girder flange.

Loading and unloading operations, in the absence of an overhead crane, are greatly facilitated by the use of the clutches previously mentioned, and also by means of adjustable legs fitted one to each girder. These legs are fitted with wheels that can be adjusted in four positions to suit the height of the floor or ballast.

When it is desired to unload a transformer without using a crane, the load is jacked up sufficiently to relieve the trolley of the weight. The legs, normally stowed away in the spaces between the flanges on the outer sides of the girders, are swung down and adjusted to suit the height of the floor; and the main girders at one end of the trolley are disengaged at the clutches. The whole bogie system at one end, complete with both girders, is withdrawn from the transformer, leaving the remaining bogie system at the other end of the load. The transformer is then clear of the trolley and can be taken away on rollers, after which the trolley is re-united and made ready for further traffic.



Courtesy] [*L.M.S.*

One of two new 60-ton trolleys introduced by the L.M.S. for the conveyance of large transformers.

Various sizes of transformers are catered for, as the distance between the side girders can be varied from 3 ft. 4 in. to 7 ft. 6 in., in increments of 5 in., by means of the sliding brackets on the swivelling bolsters.

The trolleys were built to the designs of Mr. E. J. H. Lemon, Carriage and Wagon Superintendent, after collaboration with the transformer makers. Both vehicles are fitted with compound lever hand brake applied to all four wheels of each bogie, two levers being on each side of the trolley on alternate bogies.

The 80-ton trolleys to which reference has been made are of two kinds, generally similar in design. The first type, put into service in 1926, is of heavy construction throughout, weighing 47 tons 13 cwt. complete. The side girders in this case are not detachable, and may carry short heavy loads up to the maximum, having a base length of 10 ft. and upward at a height of 3 ft. 5 in. from the rail. Removable girders 1 ft. 5½ in. in height from the rail compose the bottom of the 22 ft. well between the main girders, and are capable of carrying the full load evenly distributed. As these girders are removable, large loads of peculiar shape may extend through the bottom if necessary, to clear loading gauge limits overhead.

As is to be expected, these vehicles are considerably longer than the new 60-ton trolleys, but they will negotiate the same minimum curve of one chain radius. The extreme length of 73 ft. 8 in. is partly due to the desire not to limit the vehicles to certain areas, but to allow them to travel over various sections of the system where the strength of underline bridges restricts the axle load.

The second type was brought into use more recently and is of similar dimensions and construction, except that it has the side beams detachable in the same manner as the new 60-ton trolleys. It is rather lighter than the earlier class of 80-ton vehicle, and weigh 45 tons complete.

Vehicles of this kind are extremely useful in the carriage of bulky loads of many different kinds. These often have to be loaded "out of gauge," and for this reason great care is necessary in their transportation, which as a rule is carried out on a Sunday, for it is only on that day that arrangements may be made to have both "up" and "down" tracks kept clear.

Principal dimensions, etc., are :

Length over Buffers	62 ft. 6 in.
Centres of Main Bolsters	40 ft. 0 in.
Bogie Wheelbase	5 ft. 6 in.
Height—Rail to top of Girders	7 ft. 10¾ in. (unloaded)
Height—Rail to top of Girders	7 ft. 9¾ in. (fully loaded)
Depth of Girder at Centre	2 ft. 4½ in.
Tare of Vehicle	31 tons 10 cwt.
Load per axle under 60-ton load	11.44 tons

Locomotive Feed Water Heating

Interesting Experiments on L.N.E.R. "Pacifics"

IN the majority of locomotives at present running, the water fed into the boiler is cold, but for many years locomotive engineers have recognised that great advantages would result from heating it prior to its entry into the boiler. For instance a great saving in coal consumption would be effected if the waste heat of the exhaust steam could be transferred to the feed water, and it has been calculated that the amount of coal used on a locomotive would be reduced by 1% for every 11°F. by which the temperature of the water could be raised in this manner.

One important advantage that would be given by heating feed water is that stresses on the boiler would be reduced. The entry of a large quantity of cold water reduces the temperature considerably and this rises again as the water becomes heated. The contractions and expansions of the boiler due to successive changes of this kind may lead to trouble with stays and joints and eventually cause serious leaks. Another advantage is that a saving of water would be effected, for part of the exhaust steam is condensed and returned to the boiler.

Nord "Pacific" No. 31225 at the head of the "*Golden Arrow*." The A.C.F.I. feed water heater fitted is carried on top of the boiler between the chimney and the steam dome.

Unfortunately it has not proved easy to devise a satisfactory means of pre-heating feed water, and many difficult problems have arisen in the course of the experiments that have been made by locomotive engineers. One of the chief of these is that the injectors usually employed for feeding locomotive boilers do not work satisfactorily with hot water. Pumps have to be used instead, therefore, and it has been found difficult to produce a pump that is thoroughly reliable in all conditions of service.

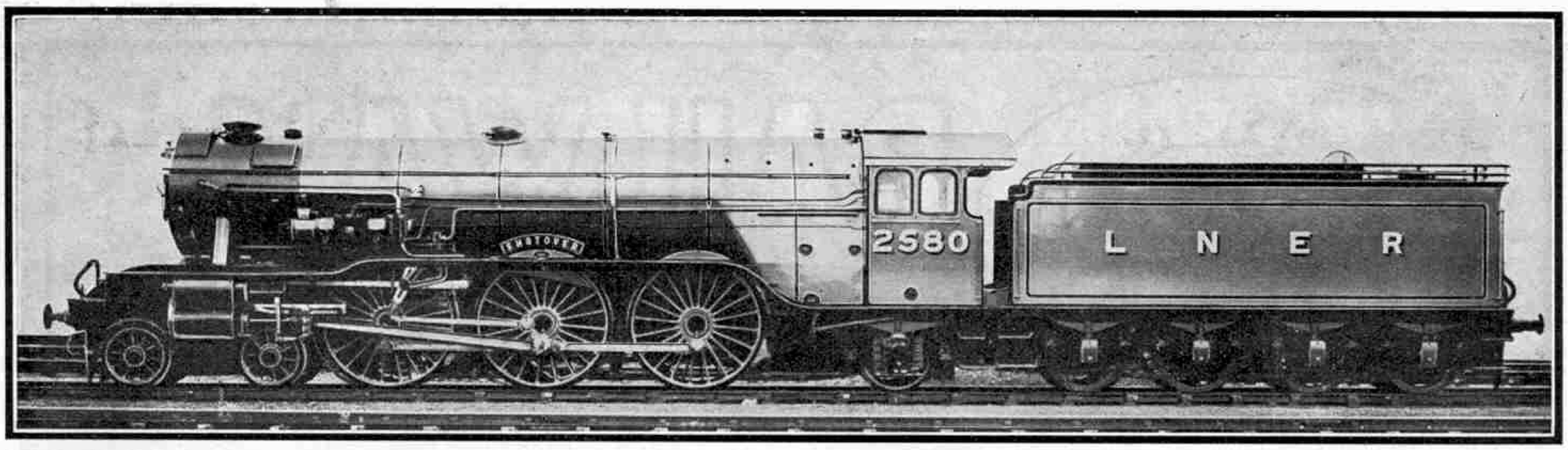
The advantages of pre-heating feed water have been so apparent to all railway engineers, however, that many of them have patiently endeavoured to overcome these difficulties. In this country the pioneers of these efforts were Mr. Joseph Beattie, an early Locomotive Superintendent of the L. & S.W. Railway, and Mr. Wm. Stroudley, who for many years held the corresponding post on the L.B. & S.C. Railway. Both produced interesting feed water heaters by means of which they endeavoured to utilise some of the waste heat of the exhaust steam.

Locomotives fitted with Beattie's earliest form of feed water heater appeared to have two chimneys. The extra fitting was a condenser in which the exhaust steam from the cylinders met a jet of cold water pumped from the tender. The heated water was delivered into a pipe that carried it back to the tender, where it mixed with the cold water and raised its temperature. When required for boiler feed purposes, the hot water could be diverted to a pump that delivered it into a tubular heater and thence to the boiler.

One fault of Beattie's feed water heater was that the oil in the exhaust steam found its way into the boiler. This engineer abandoned the jet condenser in later models, therefore, and the cold water was heated by passing it through a tube surrounded by one of larger diameter through which the exhaust steam circulated. The resulting hot water was fed to the boiler by a donkey pump on the opposite side of the engine to the ordinary cold water pump. In spite of many drawbacks Beattie's feed water heater appears to have been successful in reducing coal consumption.

It is interesting to note that Mr. Drummond, one of Mr. Beattie's successors as Locomotive Engineer of the L.S.W.R., also devised a system of feed water heating. In this case the heater was below the tender tank and a portion of the exhaust steam was turned into it. Water from the tank surrounded the pipes through which the exhaust steam passed and a duplex pump was employed to deliver the water to the boiler. Before entering the boiler the water was further heated by passing through a coiled pipe in the smoke-box.

Mr. Stroudley's pre-heater was noteworthy in that the pumps used were driven off the motion. This is not an ideal system, the chief objection to it being that water cannot be fed into the boiler when the locomotive is standing. Stroudley's system resulted in a substantial economy in fuel, and it is said that under ordinary conditions the temperature of the feed water actually



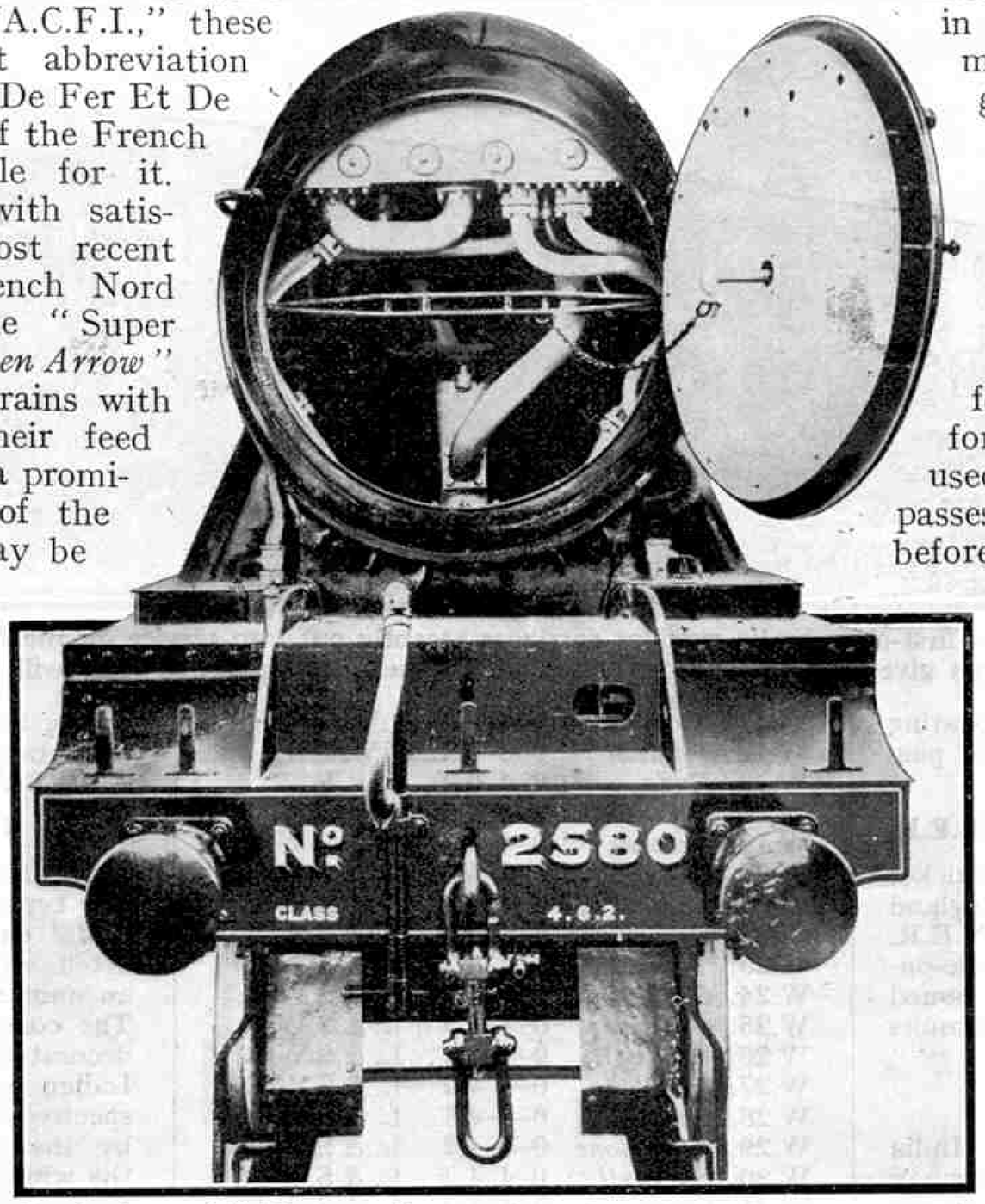
L.N.E.R. " Pacific " No. 2580, " *Shotover*," fitted with A.C.F.I. feed water heater. The feed pump may be seen above the front driving wheel. For permission to reproduce this and the photograph below we are indebted to the courtesy of the L.N.E.R.

was raised to boiling point by means of heat that otherwise would have been wasted.

The experiments commenced by famous engineers of past generations have since been continued, and in late years important developments have taken place that probably will result in a more general application of feed water heating. More efficient forms of apparatus have been devised, and are being used with considerable success in Europe and also in America.

One very promising system of feed water heating is that known as "A.C.F.I.," these letters being a convenient abbreviation of L'Auxiliaire Des Chemins De Fer Et De L'Industrie, the long name of the French Engineering firm responsible for it. This has been employed with satisfactory results on the most recent express engines of the French Nord Railway. These are the " Super Pacifics " that work the *"Golden Arrow"* and other fast and heavy trains with conspicuous success. Their feed water heaters are carried in a prominent position on the top of the boiler barrel, where they may be seen between the chimney and the dome.

In Great Britain the A.C.F.I. feed water heater is being tried out on the L.N.E.R. Some time ago it was fitted to three 4–6–0 locomotives on the Great Eastern section, and also to two "Atlantics " at work in the North Eastern Division. On these locomotives the apparatus proved so efficient that it was decided to test it further on the famous " Pacifics " designed by Mr. Gresley. The locomotives selected for this interesting experiment were No. 2580 *"Shotover,"* and 2576 *"The White Knight."*



Smoke-box of " *Shotover* " opened to show the position of the feed water heater. One of the pipes through which exhaust steam is diverted from the blast pipe is clearly visible.

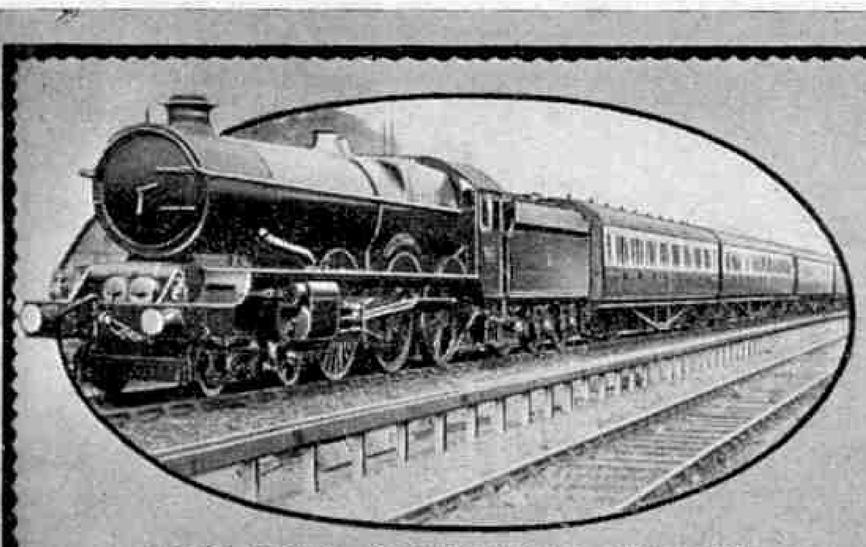
In adapting the design of the A.C.F.I. feed water heater for use on British railways a new position had to be found for it owing to the limitations imposed by the loading gauge. The heater fitted to *"Shotover"* and *"The White Knight"* is specially designed to fit inside the smoke-box in front of the chimney, therefore, and the feed pump is placed on the near side of the locomotive.

The A.C.F.I. system is fairly simple in action. Water from the tender flows into a suction vessel under the cab. From there it is pumped through into the mixing chamber of the heater. It enters this in the form of a fine spray and is heated by mingling with exhaust steam diverted from the blast pipe. The water thus heated flows to a chamber placed in the smoke-box beneath the mixer. From there it falls by gravity to the hot water cylinder of the pump and is then forced through the clack valve into the boiler.

The feed pump is of the horizontal tandem type and comprises a steam cylinder and two water cylinders, one for hot water and the other for cold. The exhaust steam used for pre-heating feed water passes through an oil separator before entering the mixing chamber, and thus oil cannot find its way into the boiler.

An interesting feature of the apparatus is that the amount of cold water delivered to the heater is greater than the quantity of hot water pumped into the boiler. The hot water chamber has an overflow pipe that leads to a return valve. This is located low down, and when a sufficient weight of water has collected the valve opens automatically and returns the water to the suction chamber. In order to prevent excess pressure from being built up in the pipeline an atmospheric pipe in the form of an inverted " U " encircles the boiler behind the fourth lagging band.

The two L.N.E.R. " Pacifics " fitted with the A.C.F.I. feed water heater have shown marked efficiency while working, and in certain tests it was found that the average temperature of the water entering the boiler was 225°F.



THE DOWN CHELTENHAM EXPRESS

RAILWAY NEWS

Opening of a New Line

A new electric railway line, 5¼ miles in length, which has been built by the Southern Railway to link up the two residential towns of Wimbledon and Sutton was opened on 5th January. There are six stations on the new line—Wimbledon Chase and South Merton, which have been open for some time, and Morden South, St. Helier, Wimbledon Common and Sutton West. There are no tunnels and no level crossings, but no fewer than 24 over and under bridges have had to be built.

The train service operates between Holborn Viaduct and West Croydon in each direction; giving connections at Sutton with services to and from Victoria, and at Wimbledon with services to and from Waterloo. The trains run every 20 minutes at the busiest periods of the day, and every 30 minutes at other times. The trains consist of eight-coach units, each train accommodating 112 first-class and 540 third-class passengers.

Passimeter Booking Office on the L.N.E.R.

The first passimeter booking and ticket collecting office in the North of England was opened recently at the L.N.E.R. station at Manors East, Newcastle-on-Tyne. Over 100,000 tickets are issued and over 200,000 collected at Manors East annually.

Electric Trains in India

The first main railway line in India to be electrified is the section from Bombay to Poona—a distance of 131 miles—on the Great Indian Peninsula Railway. The change to electric traction was made toward the end of 1929.

The line to Poona passes over the Ghat Mountains, and the average gradient for 15 miles is 1 in 40. On this climb the locomotives of the passenger trains are assisted by one of the 41 powerful electric freight locomotives that have been supplied by the Metropolitan-Vickers Company, and are the largest and most powerful of their type yet built in Britain.

Isle of Wight Locomotives

The Southern Railway has added greatly to the interest of its locomotives in the Isle of Wight by giving names to them all. The complete list is as follows:—

No. W.	Name.	Type.	Immediate former owner.
W.1.	*Medina*	0–6–0.T.	F.Y. & N.R.
W.2.	*Freshwater*	0–6–0.T.	F.Y. & N.R.
W.3.	*Carisbrooke*	0–6–0.T.	L.B. & S.C.R.
W.4.	*Bembridge*	0–6–0.T.	L.B. & S.C.R.
W.10.	*Cowes*	0–6–0.T.	I.W.C.R.
W.11.	*Newport*	0–6–0.T.	I.W.C.R.
W.12.	*Ventnor*	0–6–0.T.	I.W.C.R.
W.13.	*Ryde*	2–4–0.T.	I.W.R.
W.16.	*Wroxall*	2–4–0.T.	I.W.R.
W.19.	*Osborne*	0–4–4.T.	L. & S.W.R.
W.20.	*Shanklin*	0–4–4.T.	L. & S.W.R.
W.21.	*Sandown*	0–4–4.T.	L. & S.W.R.
W.22.	*Brading*	0–4–4.T.	L. & S.W.R.
W.23.	*Totland*	0–4–4.T.	L. & S.W.R.
W.24.	*Calbourne*	0–4–4.T.	L. & S.W.R.
W.25.	*Godshill*	0–4–4.T.	L. & S.W.R.
W.26.	*Whitwell*	0–4–4.T.	L. & S.W.R.
W.27.	*Merstone*	0–4–4.T.	L. & S.W.R.
W.28.	*Ashey*	0–4–4.T.	L. & S.W.R.
W.29.	*Alverstone*	0–4–4.T.	L. & S.W.R.
W.30.	*Shorwell*	0–4–4.T.	L. & S.W.R.
W.31.	*Chale*	0–4–4.T.	L. & S.W.R.
W.32.	*Bonchurch*	0–4–4.T.	L. & S.W.R.

Number 4 is the most recent addition and was formerly No. 678, L.B. & S.C.R. She was built at Brighton Works in June, 1880, and when new was No. 78, and named *"Knowle."*

L.N.E.R. Steam Rail Coaches

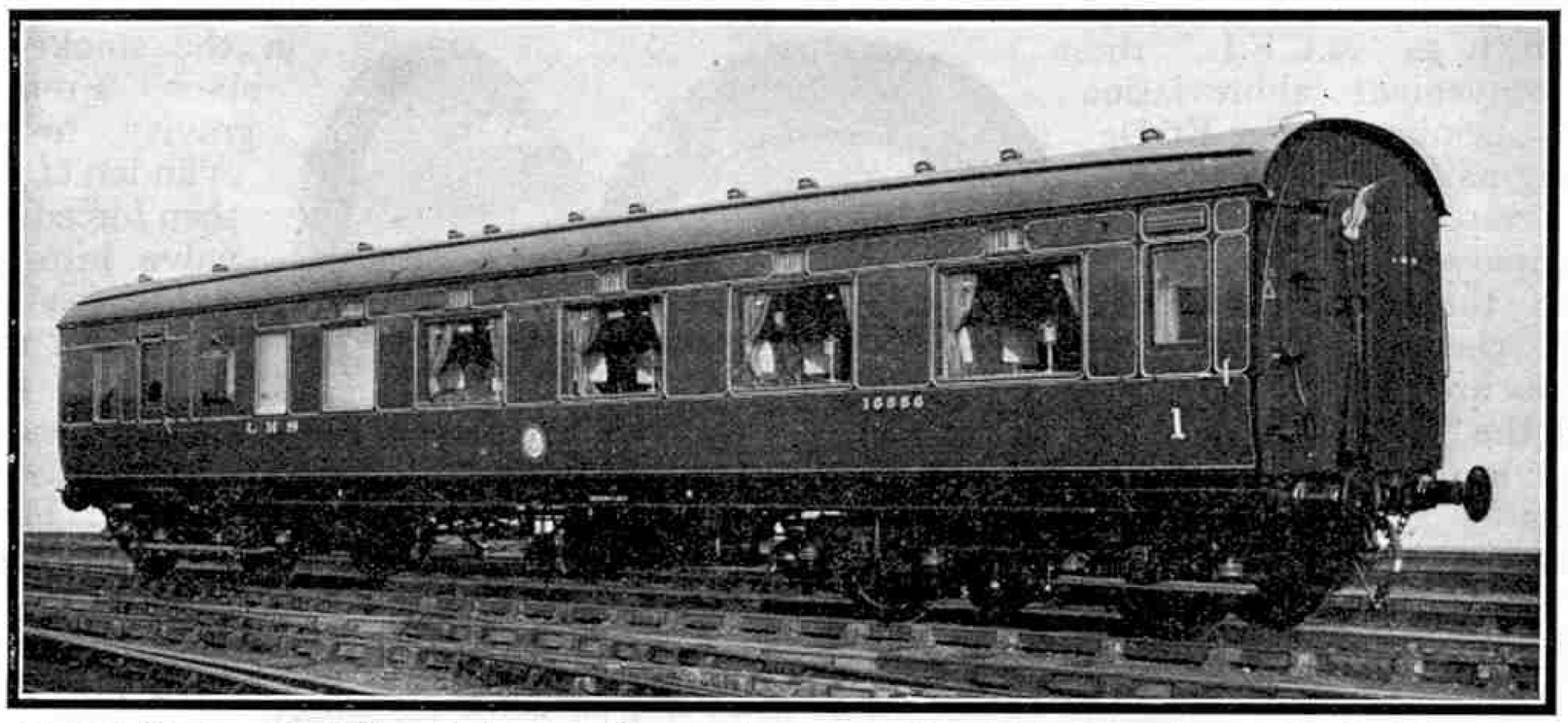
The L.N.E.R. now have 76 steam rail coaches in regular service on branch lines in England and Scotland. These are very useful for light work

Faster L.N.E.R. Service between London and Manchester

Commencing on 1st January, the L.N.E.R. effected an important improvement in their passenger train service between London (Marylebone), Leicester, Nottingham, Sheffield and Manchester.

The 4.55 p.m. express Marylebone to Sheffield was extended to Manchester (London Road), stopping only at Leicester 6.47 p.m., Nottingham 7.14 p.m., and Sheffield 8.6 p.m. The train arrives at Manchester at 9.5 p.m., thus shortening the journey time from London, Leicester and Nottingham by 44 minutes.

By this new service the total journey time from Marylebone to Manchester is 4 hr. 10 min., or 15 min. less than the time taken by the previous fastest L.N.E.R. express over this route. The most important trains on the Marylebone-Manchester services have been fitted recently with entirely new carriages, including all-electric kitchens and restaurant cars, which are now the L.N.E.R. standard.



One of the new first-class brake corridor carriages recently put into service on the L.M.S. The lower windows give an uninterrupted view and the neat steel-panelled sides will be noted.

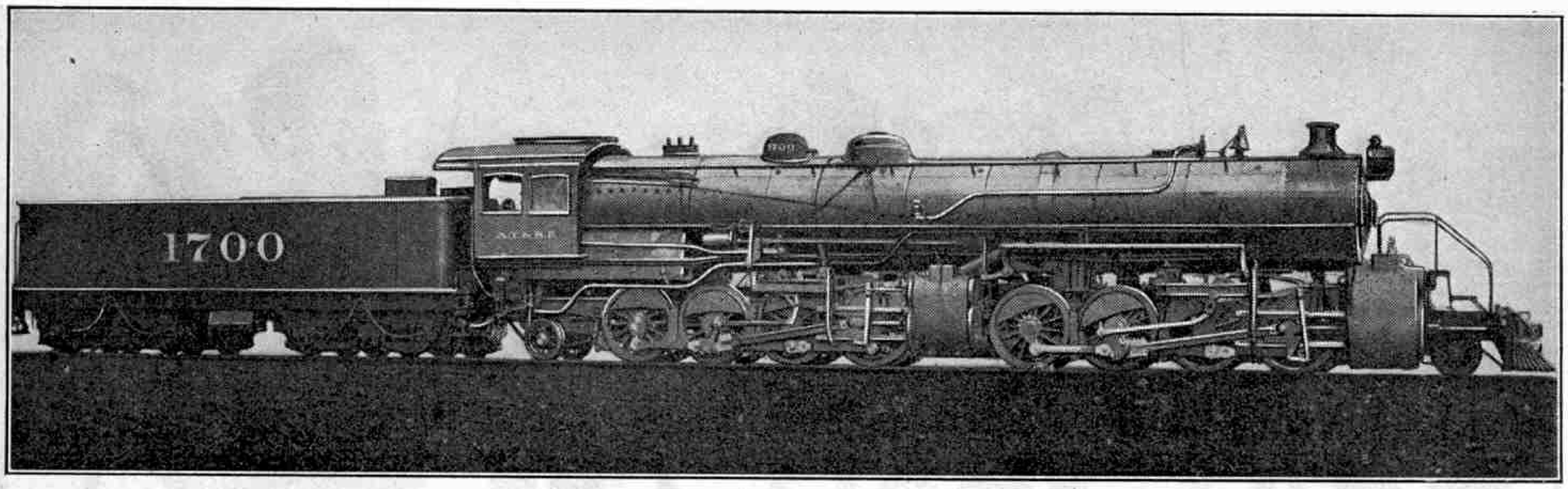
New Luxury Coaches on the L.M.S.

The L.M.S. have introduced an entirely new type of luxury coach, on their *"Royal Scot"* express, which has been specially fitted with extra large windows giving an uninterrupted view of the countryside. The coaches contain four compartments, decorated in mahogany (Chippendale style), Indian greywood, walnut and oak respectively. Ventilation can be controlled by the passenger turning a handle on the window sill, and an improved lighting system has been installed.

Vehicles of this type are also to be found on the 9.50 a.m. express from St. Pancras to Glasgow and 9.20 p.m. Glasgow-St. Pancras train.

New Halts on the G.W.R.

Since the beginning of 1929, the G.W.R. have opened 27 new Halts, making a total of 346 on various parts of the system. These Halts are a great convenience in country places where proper stations would not pay.



A large and powerful articulated locomotive of the 2-8-8-2 type belonging to the Atchison, Topeka and Santa Fé Railroad, U.S.A. A huge tender is provided, carried on two six-wheeled bogies.

L.M.S. Building Programme

At the beginning of 1929 the L.M.S. announced that the locomotive-building programme for the year included the construction at Crewe Works of a hundred 0–8–0 freight engines. The programme was carried through with remarkable precision, and several days before the year closed the last of the series, No. 9599, was completed and sent out into service. This engine had been erected in nine days, and its completion marked the achievement of a new record. The total weight of the locomotives built at Crewe during the last nine months of 1929 was 5,500 tons—a total that has never been reached before. The recent thorough reconstruction of the Works at Crewe has made such results possible.

A new series of 75 mixed-traffic engines, of the standard 2–6–0 type, has been commenced at Crewe, and 25 engines of the same class are being built at Horwich.

The L.T.S. 4–6–4 "Baltic" tank engine, No. 2105, has been to Crewe for repairs, and its number has been changed to 2197. Engines Nos. 5748 and 5778 of the 4–6–0 "Prince of Wales" class, have been adapted for working on the Midland division.

Engines of the 0–8–0 type numbered 9089 and 9126 have been converted from "G" class to "G.1" class, the change being effected by adding superheaters.

Patent Geared Locomotives for the L.N.E.R.

The L.N.E.R. have placed orders for two 200 h.p. patent geared locomotives for service on the Wisbech tramway. These locomotives will be of a special design capable of being driven from either end, and will be supplied with a governor limiting speed to 14 miles per hour. The company have also placed an order for a patent locomotive fitted with a crane and grab for lifting and loading ashes at locomotive depots.

G.W.R. Locomotive News

Further engines of the "Hall" class, 4–6–0 passenger, have been completed at Swindon. Their names and numbers are as follows: 4961, "*Pyrland Hall*"; 4962, "*Ragley Hall*"; 4963, "*Rignall Hall*"; 4964, "*Rodwell Hall*"; 4965, "*Rood Ashton Hall*"; 4966, "*Shakenhurst Hall*"; 4967, "*Shirenewton Hall.*"

The engines of the "Hall" class are establishing themselves as favourites with their drivers. Their comparatively small driving wheels—6 ft. in diameter—make them very smart in starting and powerful for up-hill work; but they show themselves also very speedy on the level and down-hill. One was timed recently at 85 m.p.h. A correspondent reports that, "travelling lately on a west to north express, between Hereford and Shrewsbury, a 'Hall' piloted by a 'County,' drew the train, and some very brisk running was made."

The ten new "King" class locomotives now under construction at Swindon are to be named:—No. 6020, "*King Henry IV*"; 6021, "*King Richard II*"; 6022, "*King Edward III*"; 6023, "*King Edward II*"; 6024, "*King Edward I*"; 6025, "*King Henry III*"; 6026, "*King John*"; 6027, "*King Richard I*"; 6028, "*King Henry II*"; 6029, "*King Stephen.*"

Photograph] [*Railway Photographs, Liverpool*

L.N.E.R. Up Mineral Train, emerging from Hadley Wood Tunnel. 2-8-2 Engine No. 2393, with "booster."

Colour Light Signals on the S.R.

The Southern Railway are steadily extending in the London suburban area the use of colour light signals in place of the usual semaphore type. The latest portion of the line to be operated by this method is the one from Spa Road to New Cross, and the signals that are used are known as four-aspect colour light signals.

Each running signal consists of a group of four lamps and the light aspect exhibited at any one time is either red, or yellow, or two yellow, or a green light. These signals are arranged either vertically, that is to say, one lamp above the other, or in a cluster, but in either case the arrangement of aspects as seen by a driver is the same. It has been found that the introduction of colour light signalling, which is already installed on a large part of the Southern Railway suburban system, has led to a general speeding-up of all traffic under normal conditions and is a great help in foggy weather, as these lights are so powerful that they are visible, even in a thick fog, for a considerable distance.

More "Garratt" Engines for the L.M.S.

The L.M.S. have had three "Garratt" articulated locomotives in service since 1927, and these have proved so satisfactory that an order has now been placed with Beyer, Peacock & Co. Ltd., of Manchester, for 30 more. These are intended for ordinary traffic working and not just for exceptional duties. They will be employed for hauling heavy goods and mineral trains.

The wheel arrangement of the new engines will be 2–6–0+0–6–2. They will have exceptionally large boilers and a grate area of 44.5 sq. ft., and will develop a tractive effort of 40,250 lb. In working order, with nine tons of coal and 4,500 gallons of water, each will weigh 150 tons.

WHAT SHALL I BE

IV.—WIRELESS ENGINEERING

LAST month we described the possibilities of a career in the electric supply side of electrical engineering, and the best methods of entering upon such a career. This month, in response to widespread requests, we deal with what is rather loosely described as wireless engineering.

First of all we must emphasise the fact that wireless engineering is a specialised branch of electrical engineering. The training of a wireless engineer must inevitably follow to a great extent the same line as that of an ordinary electrical engineer, and therefore much of the advice that was given in our previous articles applies equally to the boy who aims at becoming a wireless engineer.

The manufacture of the great variety of component parts of wireless installations of all kinds has rapidly developed into a vast industry, giving employment to a small army of workers.

A large proportion of the operations involved in making such components is routine work requiring nimble fingers rather than expert knowledge, but there is a wide field of opportunity for a trained electrical engineer in the design and improvement of wireless apparatus. Owing to its comparatively short history the wireless branch of electrical engineering has developed with enormous rapidity, and it is likely to continue to do so for many years. This means that wireless apparatus is undergoing constant revision and change to keep pace with the results of research, and consequently a thoroughly trained wireless engineer with real ability and original ideas has ample scope for his energies.

In order to succeed as a wireless engineer a boy must first of all acquire a sound knowledge of the general principles of electricity and electrical engineering, together with practical workshop experience. The best means of acquiring the latter is to take up an apprenticeship with a good firm of electrical engineers, who undertake a considerable variety of work. How this may be done was fully explained on page 918 of the "*M.M.*" for December last.

Those who wish to qualify for the highest posts should, most certainly, take a degree in engineering at a recognised University. The man who has an engineering degree, in addition to sound practical experience, is in a far better position to obtain a good post than one who can only refer to his practical experience, even though his knowledge may be equal to that of the University man. It cannot be too strongly emphasised that this is the case in all branches of engineering. A University degree provides a certain guarantee of expert knowledge, and this has a great deal of influence with those in whose hands lie the making of important appointments of the highest class.

The qualifications required in candidates for employment in the technical posts connected with broadcasting, are similar. The handling and supervision of the transmitting apparatus of a big broadcasting station involve very heavy responsibilities, which can be discharged satisfactorily only by men with a thoroughly good all-round knowledge of electrical engineering and, in addition, a special knowledge of wireless theory and practice. There is very little opportunity for a young man to enter the service of a broadcasting station and work his way up. The available openings are almost entirely confined to men coming in from outside, already possessing adequate training and a fair amount of experience.

A modern broadcasting station is far more than a mere transmitter, however, and there is scope for skilled engineers in many other directions, such as the production of the necessary power and the erection and maintenance of plant and aerials.

Among the many interesting tasks that fall to the lot of the engineers of a broadcasting company is that of preparing for outside broadcasts, such as theatrical performances, concerts, speeches, etc. This is work that demands special qualifications and in which an engineer's suitability or otherwise is quickly evident. The conditions for outside broadcasts of this kind are never twice alike, and the engineers concerned must continually be devising means of surmounting new and often unexpected difficulties. The enormous progress that has been made in this direction will be realised by those who remember the weird and wonderful results obtained in the early days of broadcasting, and compare them with the marvellous achievements of to-day.

Still another interesting branch of the work of the wireless engineer is concerned with the preparation of land lines for transmissions over long distances. This involves many serious technical difficulties. A line that is quite suitable for use for ordinary telegraphy or telephony may prove utterly useless for the transmission of music until it has been specially cleared for the purpose. Much remains to be done in this direction, and here again there is scope for enterprising engineers.

A career that may be considered along with Wireless Engineering is that of wireless operator on board a sea-going vessel. This is a calling that has a great fascination for most boys, and its many possibilities make it eminently suitable for the right type of youth.

FAMOUS ENGINEERS—4

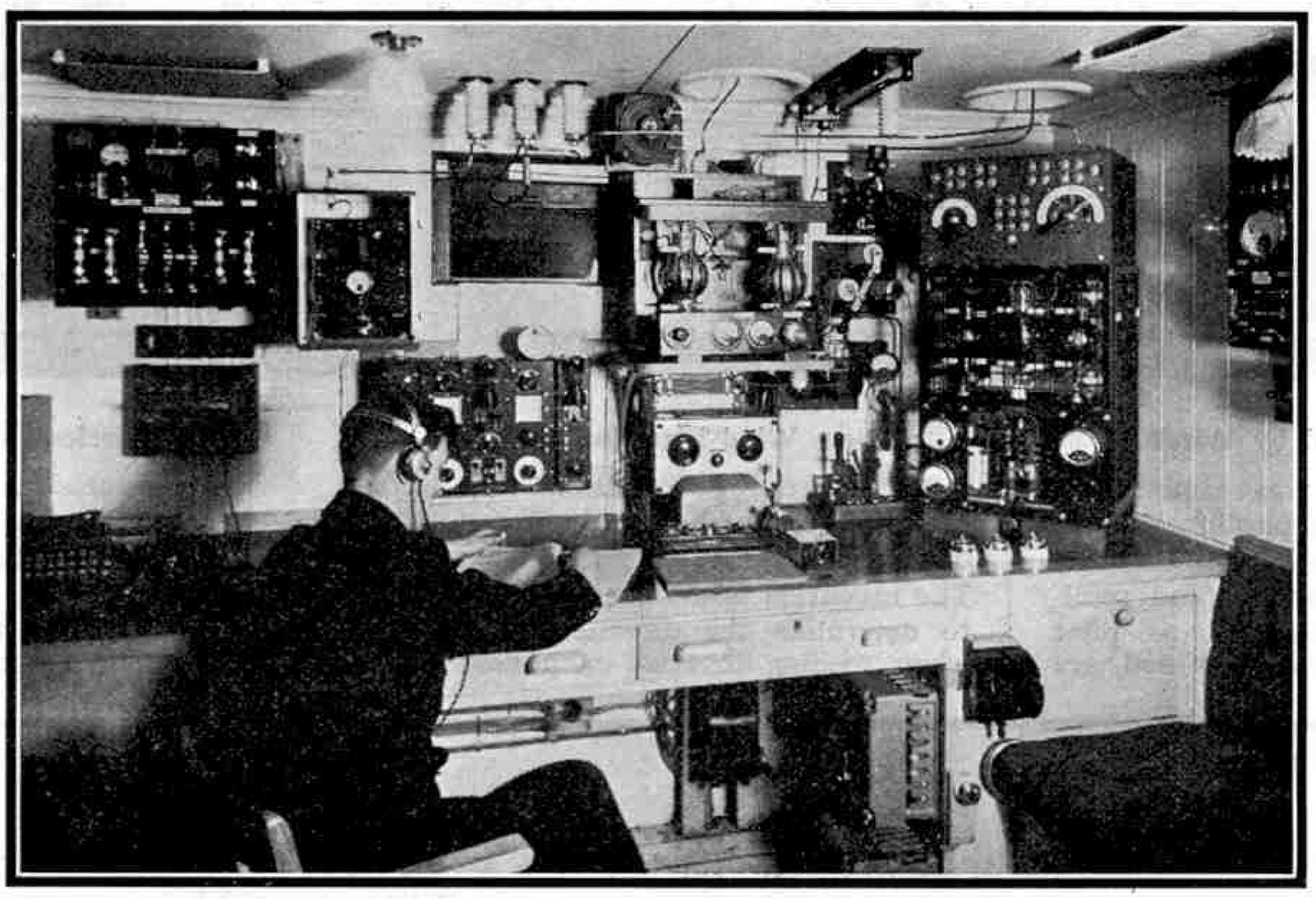
Mr. Noel Ashbridge, B.Sc., A.M.I.C.E., is the Chief Engineer of the British Broadcasting Corporation. He received his engineering training at King's College, London, and subsequently was engaged in the works of the British Thomson-Houston Co. and the Lancashire Dynamo Co.

During the war Mr. Ashbridge saw service in France as wireless officer with the Royal Engineers, and afterwards he entered the service of the Marconi Wireless Telegraph Company. For several years he was head of the experimental section at Writtle, near Chelmsford. He joined the B.B.C. as Assistant Chief Engineer in 1925, and last year was appointed to the responsible position of Chief Engineer.

It appeals to the romantic side of human nature and at the same time it is scientific in character—a combination that presents a great attraction to the modern boy.

The majority of wireless operators on British ships are employed by the British Wireless Marine Service or Messrs. Siemens Bros. & Co. Ltd. The first-named of these is a Joint Service Department of the Marconi and Radio Communication companies. In addition to the operators supplied by these two companies there are a number engaged directly by certain shipping lines.

Any boy or young man who wishes to secure an appointment on the staff of any organisation employing wireless operators must possess the Certificate of proficiency in Wireless Telegraphy that is issued by the Postmaster-General. This all-important certificate is granted as the result of an examination open to candidates who are of British nationality, and in order to secure it the wisest course is to attend one of the approved wireless telegraphy training schools in London or in the provinces where suitable training is given. The names of these schools may be obtained on application to any of the firms employing wireless operators, and those who intend to embark on the career of wireless operator at sea should obtain this information as a necessary preliminary.



Marconi Wireless Equipment on the "*Discovery II.*" This vessel is now on the way to the Antarctic on a voyage of scientific exploration.

The most suitable time for entering a training school is when the intending operator is between 16 and 20 years of age. No fixed standard of education is required, but preference is given to youths having a secondary school education. Those who have a good elementary education and are of average intelligence should have no difficulty in reaching the necessary standard, however, and it is well to note that ability to write clearly and distinctly is an essential qualification.

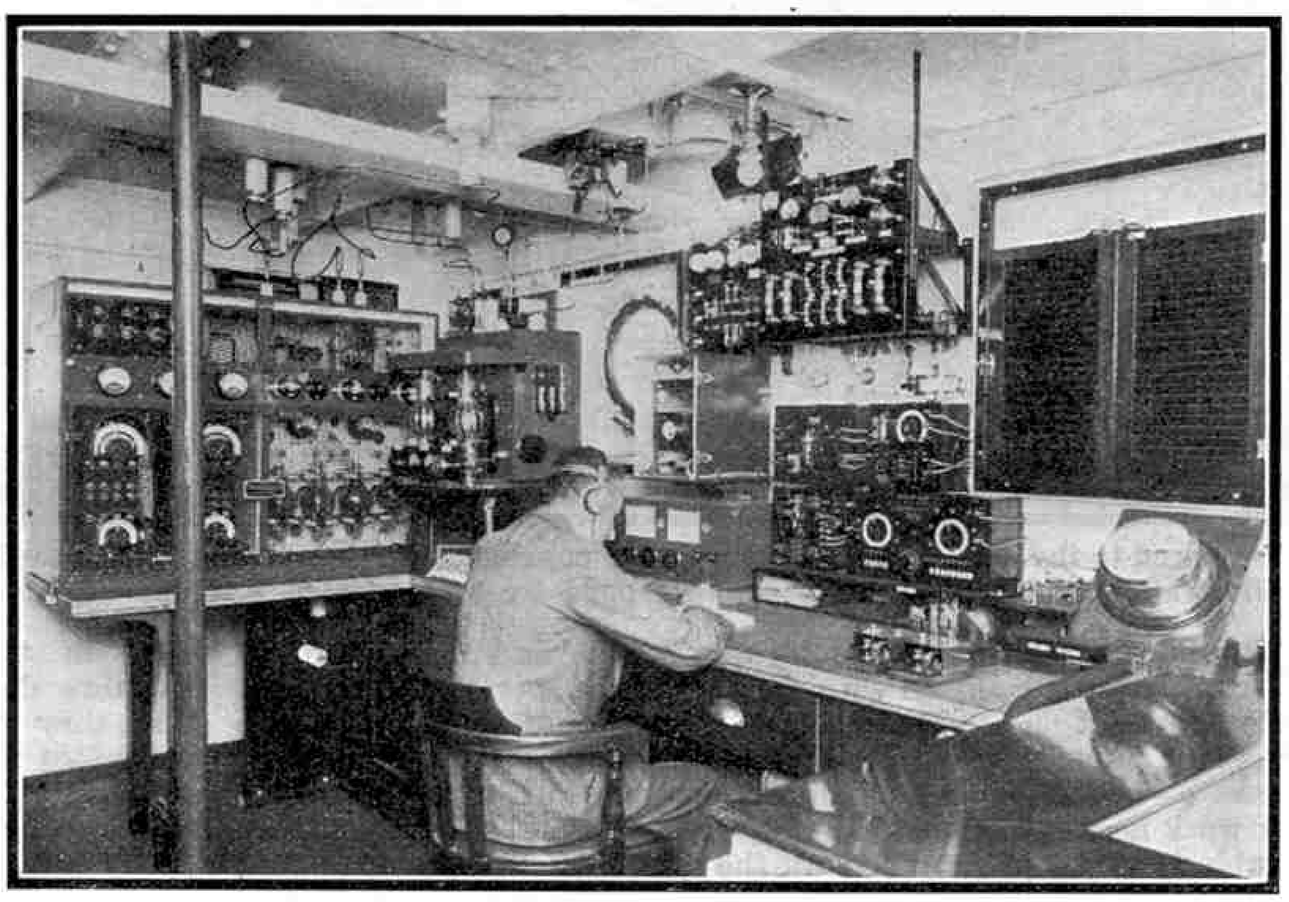
On obtaining a Certificate the first sea-going appointment open is that of Grade 3 operator, to which is attached a salary of £7 per month. After service at sea for six months the operator is transferred to Grade 2. This means an increased salary of £8/10/– per month, that six months later rises to £9/10/–, and becomes £10/10/– after a further service of one year.

Promotion to Grade 1 follows at the end of a total service at sea of three years. In this Grade the salary varies from £13 to £19 per month according to the class and tonnage of the vessel on which the operator is serving. Maintenance and accommodation are provided on board and certain allowances are made to those who remain abroad for long periods. In addition the operators engaged in vessels in which a continuous watch is maintained receive an extra allowance of £1 per month, while on certain classes of vessels, such as oil tankers, the rate of remuneration also is increased.

The wireless operator on board ship holds a very responsible post, and is often required to make quick decisions and to take swift action. The life has many advantages, however. It gives opportunities for the study of customs in other countries and although in large passenger liners and similar vessels the duties are very arduous, in many boats the operator will have time to study and improve his knowledge of his calling. Every advantage should be taken of this, for promotion to higher appointments depends on merit as well as on length of service. It is from the ranks of the operators that inspectors and other higher officials of the British Wireless Marine Services are drawn, and at the present moment all the higher shore appointments in this company are held by men who began their careers as sea-going operators.

Although not usually regarded as an engineer, a wireless operator on a ship, especially on one making long voyages, must be capable of keeping his equipment in good order. This applies not only to the actual transmitting and receiving apparatus, but also to the machinery from which his power supply is drawn. For this reason his training must be thorough and thus should include far more than instruction in sending or receiving messages in Morse code.

The course necessary to enable a would-be operator to qualify for the Postmaster-General's First Class Certificate usually occupies 12 months, and includes tuition in the general principles of electricity and magnetism and of wireless telegraphy and telephony. On the practical side candidates for the Certificate must be familiar with the adjustment and operation of all types of transmitters and receivers, including direction finders and accessory apparatus. Ability to send out, and receive by ear, messages in plain language at a speed of 25 words per minute also is necessary.



Photos Courtesy] [*Marconi Wireless Telegraph Co. Ltd.*

The wireless room on the liner "*Orontes.*" The Marconi equipment on this vessel includes transmitters and receivers for both long and short wave communication with other vessels, or stations on shore.

A recent development of wireless engineering is the provision at points round our coasts of stations from which ships may obtain their bearings. The equipment on board may include direction-finders, or consist only of the ordinary transmitting and receiving outfit. In the former case the operator may determine his position directly, but this cannot be done in the absence of apparatus specially designed for the purpose. In order to meet these cases wireless beacons and lighthouses are being planned, and trials already made have given very promising results.

Further extensions on these lines will involve the erection of what may be described as miniature broadcasting stations. For their operation and maintenance skilled wireless engineers will be required, and as the number of such stations increases they will provide additional openings for men who have had the necessary training. As in practically all instances where wireless engineering is concerned, those who have an expert knowledge of electrical engineering will have the best opportunities of securing positions of this kind.

Aeroplanes Controlled by Wireless

Considerable interest was aroused recently when it became publicly known that the world's largest air powers are experimenting with automatic and semi-automatic apparatus designed to pilot aeroplanes. The nations concerned are Great Britain, U.S.A. and France. Unfortunately, little reliable information concerning the experiments that have been carried out is available, the details naturally being kept secret by the powers concerned.

It seems that the first attempts at automatic control were made by the British Air Force about a year ago. The apparatus used weighs about 100 lb., and has recently been fitted in a flying boat. Similar experiments in France are reported to have given satisfactory results. On one occasion an aeroplane took off without anyone on board, and flew to a pre-arranged spot, where a number of bombs were dropped. The bomber then returned to the aerodrome from which it had started, and made a perfect landing. In this case the aeroplane was controlled by means of wireless.

Aircraft used for this type of work need not necessarily be inherently stable to any great degree, for while in actual flight, they are automatically controlled by a special gyroscopic apparatus that operates the controls when the machines deviate from their intended course. It will be seen that this is an interesting development of the use of the gyroscope for automatic steering purposes on large sea-going vessels and on torpedoes.

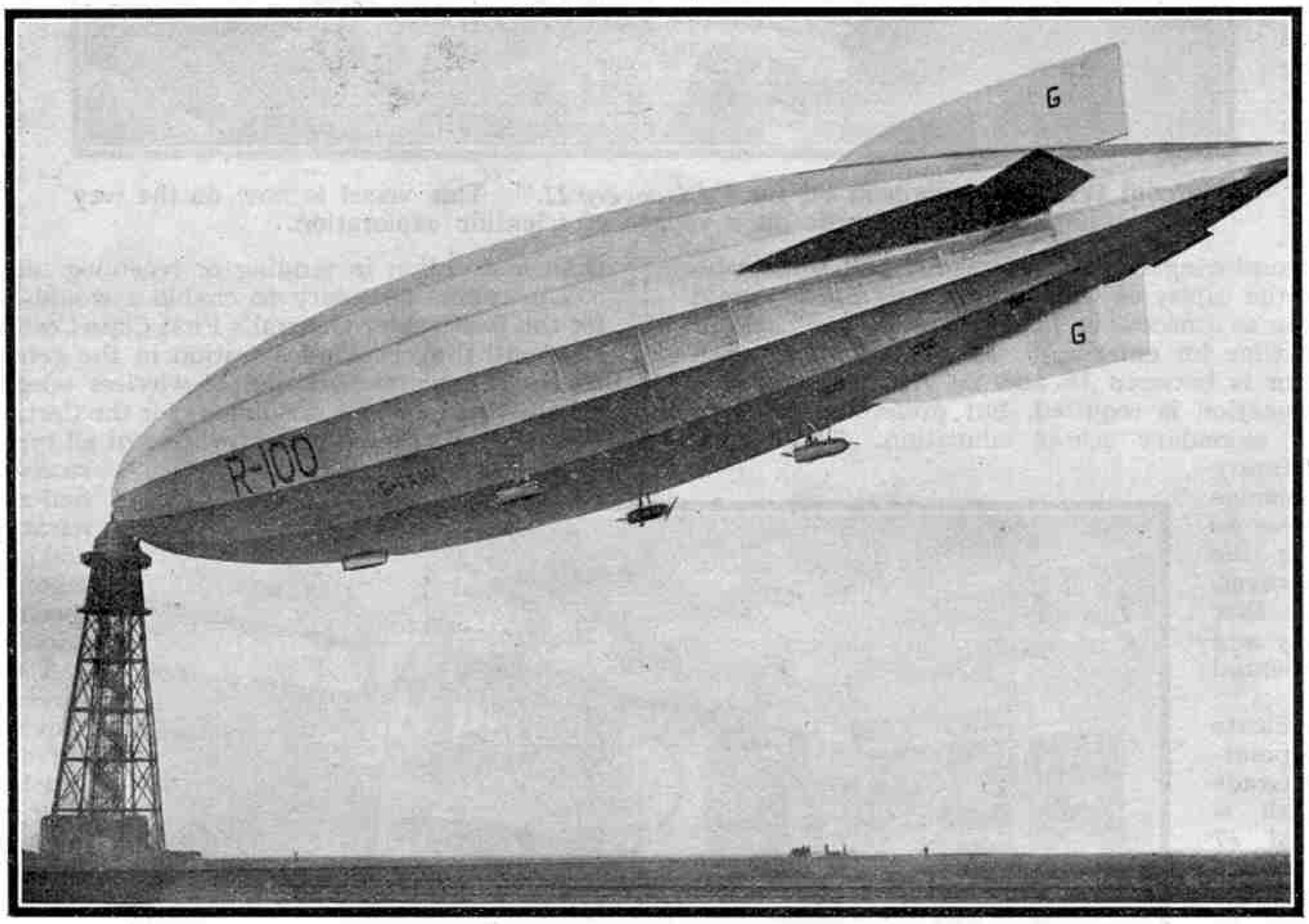
Further experiments in this direction are awaited with great interest, for there can be no doubt that the experience gained would be of great use during war-time.

New Wind-Direction Indicator

An interesting invention that should prove of great value to aviators, has been developed by Flg. Off. J. G. D. Armour. The invention is designed to enable pilots to determine the direction of the wind when wishing to land on a field that is not a regular aerodrome, and thus is not fitted with a wind indicator.

The apparatus consists of a rectangular steel box in which there is room for six glass cylinders each of which is filled with chemicals that give off dense fumes upon contact with the air.

The container is firmly secured on the floor of the cockpit, and in front of the pilot, and is operated by a Bowden cable which, when pulled, allows one cylinder to fall through a hole in the bottom of the fuselage, on to the ground below. The container is hermetically sealed to prevent fumes leaking through into the cockpit in the event of any of the cylinders breaking before being released. The chemicals inside the cylinders are claimed to be perfectly harmless, and will not cause a fire, even if dropped into a hay field.



***"R100"* moored to the mast at Cardington at the conclusion of her flight from Howden. For this illustration and those on the opposite page we are indebted to Rolls-Royce Ltd.**

Wireless for Civilian Aviators

An interesting feature of the training afforded at the flying school operated at Heston Air Park, is that all pupils are now instructed in the use of wireless apparatus of a type that is standard on many R.A.F. machines. Although the machines are equipped with receiving apparatus only, inexperienced pupils are able to remain in touch with their instructors while making their first few solo flights. In this way many accidents due to nervousness may be prevented and collisions with machines piloted by other inexperienced pupils also may be avoided.

It is probable that in time all British machines, except possibly single-seater fighting aircraft, will be provided with wireless receiving apparatus. All aircraft used by Imperial Airways are now equipped with wireless receiving and transmitting apparatus, and pilots may keep in touch with officials at headquarters during the whole of the time that they are in the air. A movement is on foot in the United States to compel all liners operating on American air routes to be equipped in a similar manner.

Rapid Air Line Flights

An Imperial Airways "Argosy" machine recently covered the 320-mile journey from London to Cologne in a flying time of only 145 minutes, a ground speed of 132 m.p.h. The journey by boat and train takes from 15 to 20 hours.

Another good journey was made by a sister ship, carrying 17 passengers and a crew of three. This machine flew from London to Paris, 225 miles, at an average ground speed of 145 m.p.h. Both these times just failed to surpass the records.

Interesting American Amphibian

One of the most interesting amphibian flying machines at present in production is the Keystone-Loening Amphibian Air Yacht. This machine was the first to be constructed for this company after its formation by the amalgamation of the Loening Company and the Keystone Aircraft Corporation.

The Keystone-Loening air yacht is developed from the standard type of amphibians that have been constructed for the U.S. Navy and Army Air Services during recent years. It is a biplane with a span of 46 ft. 8 in., and is 34 ft. 8½ in. in length. It measures 13 ft. 2 in. in height when in use as a land machine, and the wing area is 517 sq. ft. The weight empty is 3,900 lb., while a paying load of 1,100 lb. may be carried. The maximum permissible load is 5,900 lb., and the wing loading is 11.4 lb. per sq. ft. A 325 h.p. Wright "Cyclone" engine is fitted, and an unusual feature of the machine is that an airscrew of the three-bladed type is employed.

The machine has accommodation for six passengers in the cabin, which is 10 ft. in length, 4 ft. in breadth, and 5 ft. 6 in. in height. The cabin has three doors, one on each side for entry and exit, and a third at the front by means of which direct access to the pilot's cockpit may be obtained.

The hull of the machine is similar in general appearance to the original type designed by Mr. Loening, who is probably the world's most experienced designer of amphibian aircraft. Wing-tip floats are provided, as also are retractable floats for use on land. When not required the wheels fold into special receptacles situated on the top of the hull.

The yacht has a maximum speed of 130 m.p.h., while the speed for ordinary cruising purposes is 105 m.p.h. The landing speed is 55 m.p.h., and the machine possesses a ceiling of 15,000 ft., and a cruising range of 550 miles.

Monster Aeroplane for America

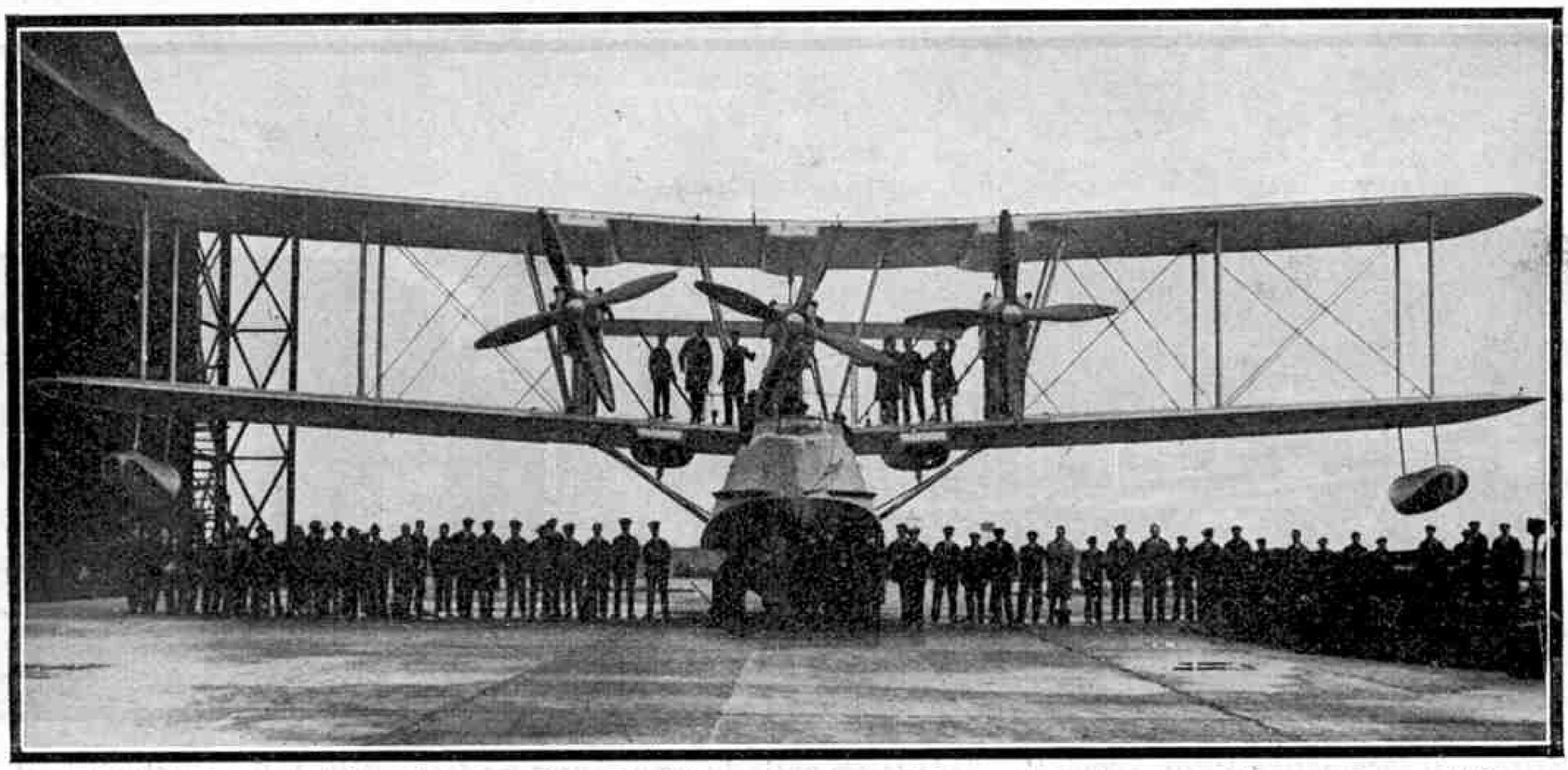
A proposal to construct four giant aeroplanes, each costing about £100,000, has been made by a firm of American engineers. Although full details of the projected machines are not yet available, it has been stated that they will be capable of carrying 160 passengers and a crew of 17, on long distance flights.

British Aircraft Exports

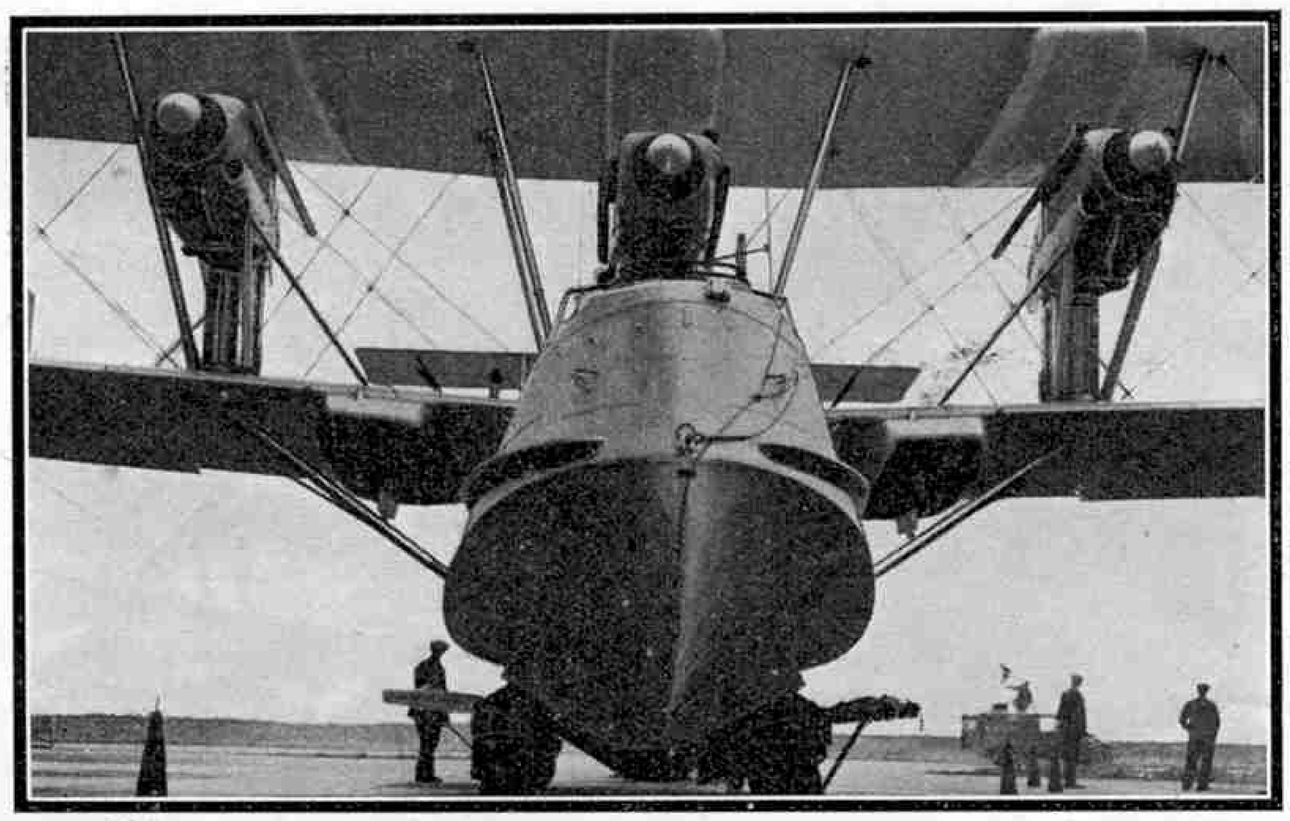
According to figures published by the Department of Overseas Trade, there was a remarkable increase in the number of complete aeroplanes exported from the United Kingdom during 1928. The exact number was 358, and the value £450,552, while in 1927, only 140 aircraft, value £205,183, were exported. The 1927 figures showed a decrease against those for 1926, in which year 150 aeroplanes were exported. The value of these machines was £391,471.

It is frequently asserted that British aircraft and aero engines are the best in the world. This statement, as far as the aircraft are concerned, is borne out by the fact that throughout 1928, only 162 aircraft, valued at £351,930, were exported from the United States.

The number of aero engines exported has shown a steady increase during the three years under consideration. In 1926, only 266 complete engines, value £296,347 were sent abroad, but during 1927, this figure increased to 380 engines, valued at £396,143. At the end of 1928, a total of 432 engines had been exported during the year. The value was £348,606.



Britain's largest flying boat. The Blackburn "Iris" III, on the slipway with members of the R.A.F. and the Blackburn Aircraft Works.



A close-up view of the massive hull of the Blackburn "Iris" III. This British flying boat is equipped with three 650 h.p. Rolls-Royce "Condor" engines similar to those fitted to the "*R100*."

New Cabin Monoplane for Imperial Airways

A new aeroplane has recently been added to the air fleet of Imperial Airways Ltd. The machine is of the Westland IV cabin monoplane type, and is the only machine owned by the Company that is not a biplane.

The aeroplane has been lettered G-EBXK, and has been specially designed for long distance charter work. It has accommodation for four passengers in an extremely comfortable cabin. Each passenger has a separate cushioned arm-chair, two of the four being arranged to face forward, and the remaining two aft. A small folding table is fixed beside each chair.

The cabin is decorated in polished mahogany and whitewood, and has curtained windows and a carpeted floor, while the usual racks for light luggage are fitted above the windows. A clock is provided and height and speed indicators similar to those in the pilot's cockpit also are fitted. By a special system of ventilation, the temperature can be regulated at will by the passengers. The cabin is situated immediately below the wing, thus providing an uninterrupted view of the ground below.

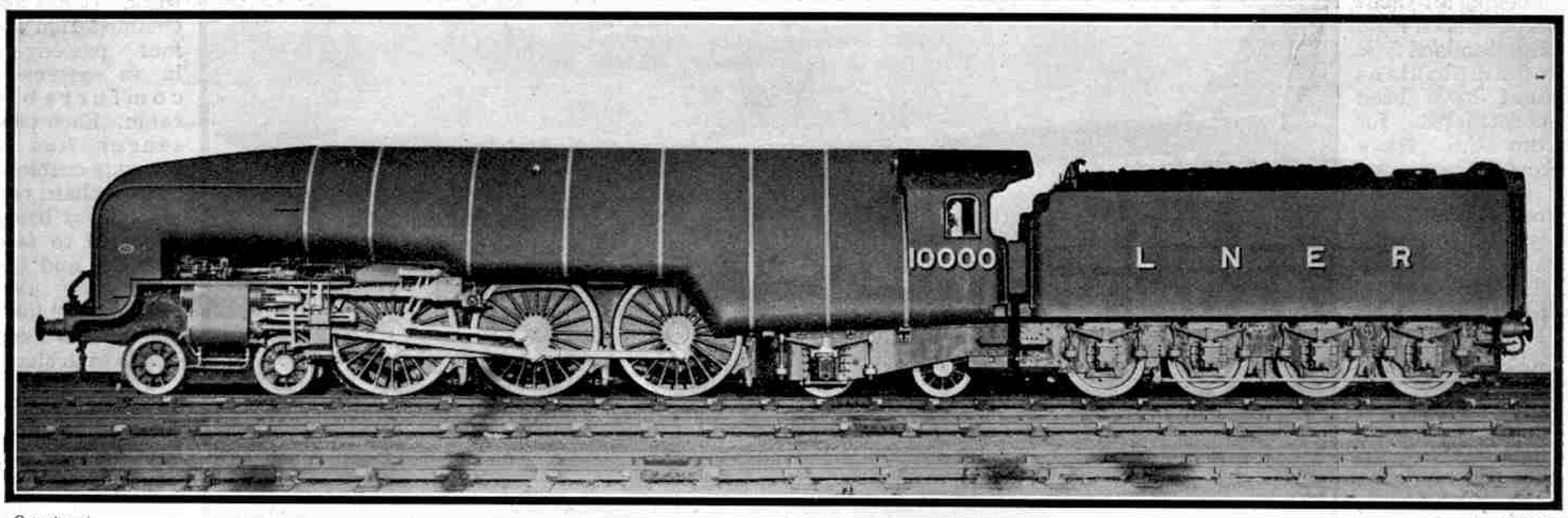
The pilot's cockpit is entirely enclosed and is provided with seats for the pilot and his mechanic. It is forward of the passenger cabin, and is connected to it by a communicating door. In addition to the usual instruments and controls a mirror is fitted in which the pilot can see a reflection of the tail unit. This enables him to see that everything is clear, both in the air and on the ground, before taking off.

The landing wheels are fitted with brakes, and have a fairly wide track, a necessity for aeroplanes used for special work of this kind, in the course of which it is sometimes necessary to visit aerodromes where the ground is uneven, or to land on any field adjacent to the passengers' destination. The wideness of the track also adds considerably to the stability of the machine when landing, taxying, or taking off.

The monoplane is equipped with three "Cirrus-Hermes" engines. A description of this engine and of the "Cirrus" engine from which it was developed was given on page 12 of the "*M.M.*" for January, 1930. The machine has a cruising speed of 90 miles per hour, and is able to maintain height when only two engines are running.

The New High-Pressure Locomotives

Bold Departure from British Practice

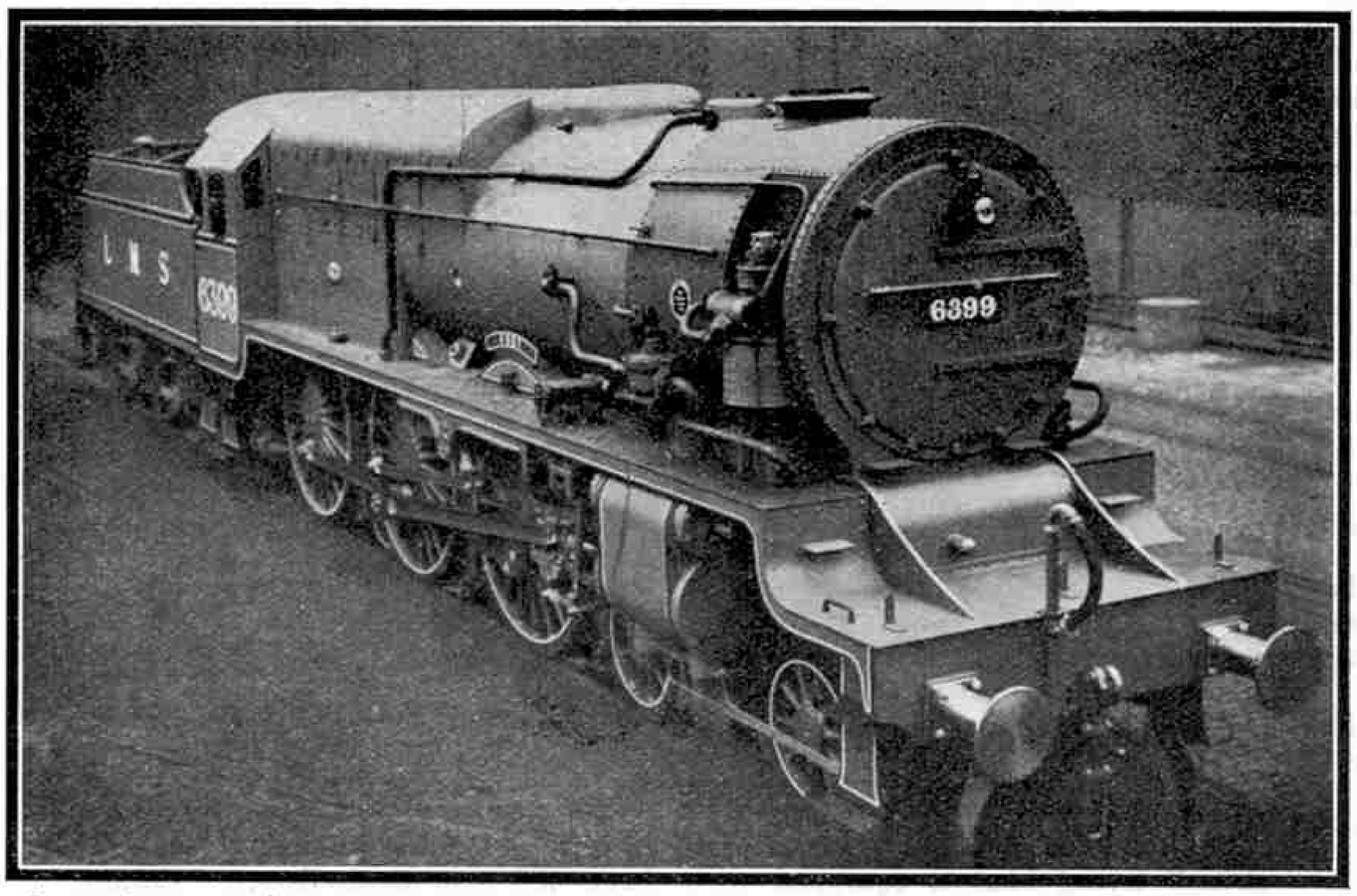


Courtesy] [*L.N.E.R.*

The L.N.E.R. experimental locomotive "No. 10000." This is an entirely new departure from British locomotive practice, and has a boiler of the water-tube type with a working pressure of 450 lb. per sq. in.

ONE of the most interesting recent events in the British railway world was the appearance shortly before the close of last year of two experimental locomotives employing high-pressure steam. In Germany and the United States considerable attention has been paid for some time to the possibilities of high boiler pressures. In this country, however, except in the case of one or two unusual types of goods engines, the maximum boiler pressure has been about 250 lb. per sq. in., as used in the G.W.R. "*King George*" and the L.M.S. "*Royal Scot.*" The new locomotives break away completely from previous British practice, and their trials will be watched with keen and widespread interest.

The first of the high-pressure locomotives to appear was "No. 10000," built at the Darlington Works of the London and North Eastern Railway. In outward appearance this new locomotive is an entire departure from previous practice in locomotive design in this country, and many of its constructional details are novel and extremely interesting. The design was finally arrived at as the result of tests that were made with a model of the locomotive in a wind flume with air currents of speeds up to 50 miles per hour.



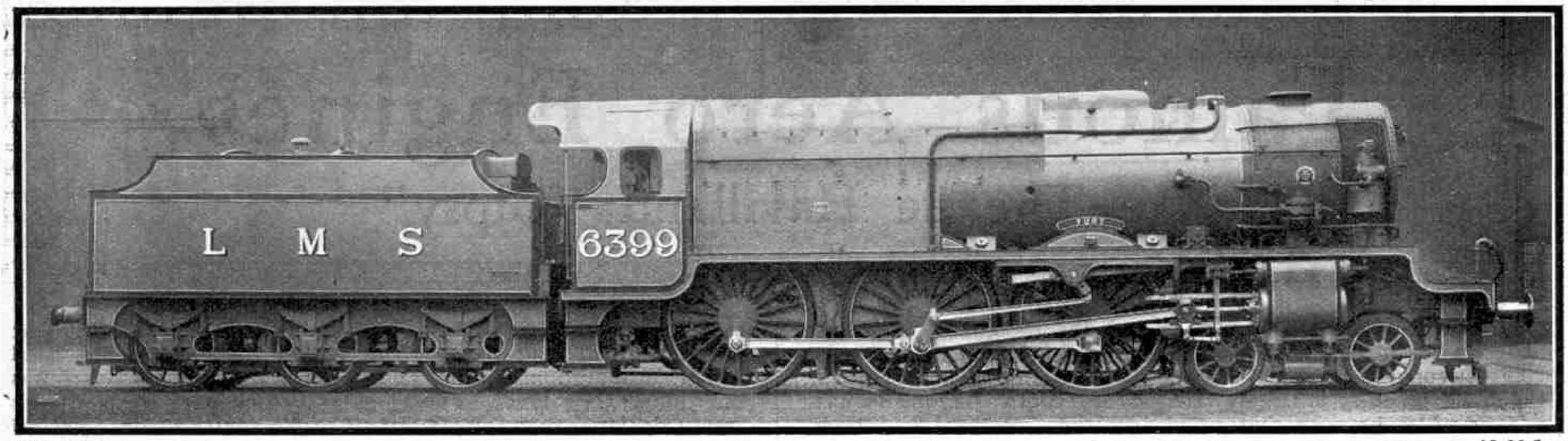
Courtesy] [*L.M.S.*

The new L.M.S. high-pressure engine, which follows the design of the "Royal Scot" class with regard to the frame, but is fitted with a boiler designed on the Schmidt high-pressure system.

The boiler has been built to the extreme limits of the railway gauge, with the result that there is no room for a chimney to project above the boiler. This difficulty has been overcome by sinking the chimney within casing plates, which are arranged in such a manner as to throw the smoke upward in order to give the driver a clear view from his position on the footplate.

The locomotive has been designed for the unusually high working boiler pressure of 450 lb. per sq. in. This high pressure has necessitated the use of a boiler of the water tube type, which has never previously been applied to a locomotive in this country, although it is used to some extent in the latest American practice. The boiler, which has been designed jointly by Mr. H. N. Gresley and Mr. Harold Yarrow, was manufactured by Yarrow & Co. Ltd., of Glasgow.

The engine is a four-cylinder compound. The two high-pressure cylinders, which are made of cast steel—a new feature—are 12 in. in diameter by 26 in. stroke, driving on to the leading coupled wheels. The two low-pressure cylinders are situated outside the frames and drive the intermediate pair of coupled wheels. These cylinders have a diameter of 20 in. by 26 in. stroke, and they and the connecting rods,



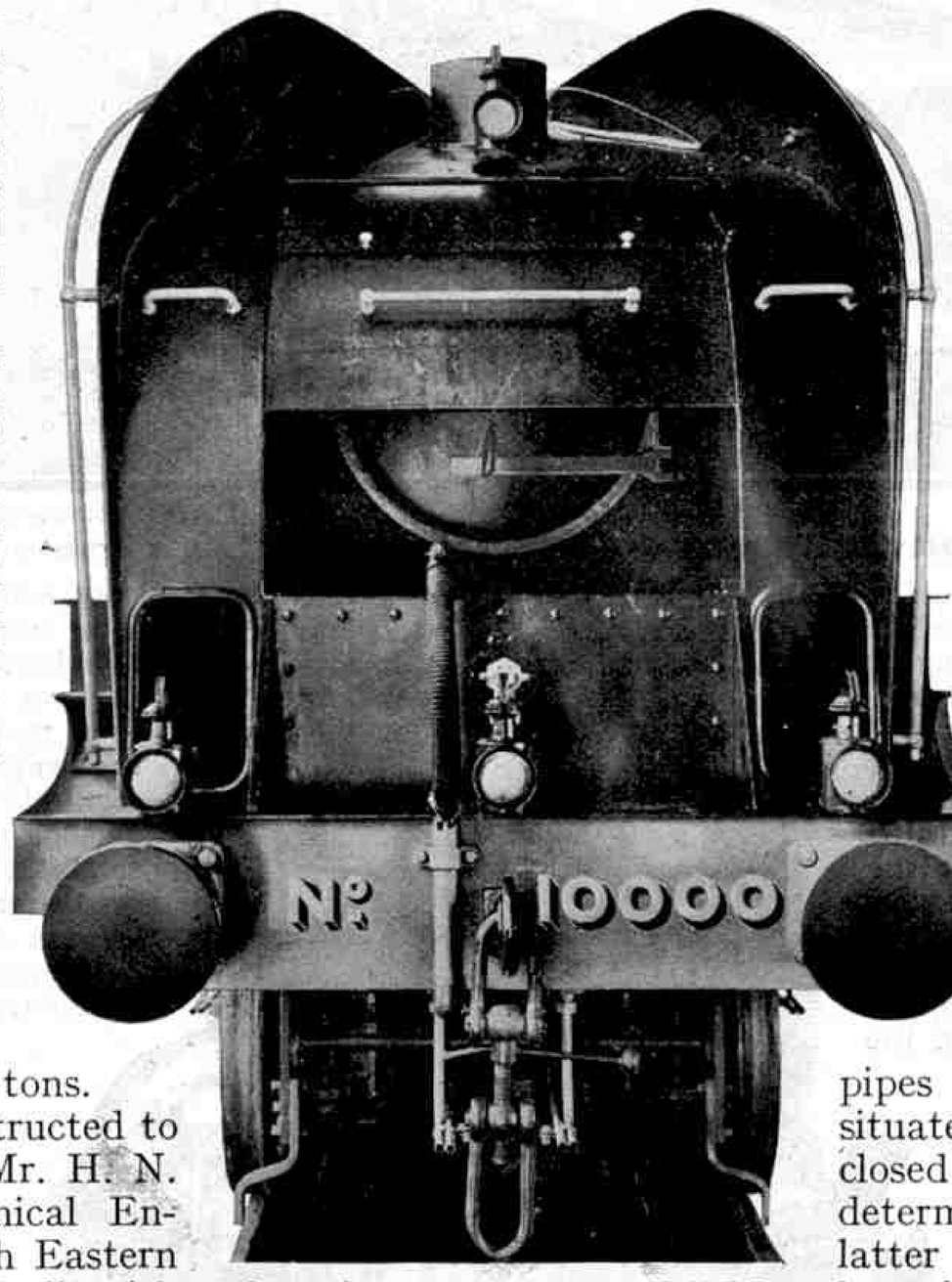
Courtesy [*L.M.S.*

A broadside view of the L.M.S. high-pressure locomotive "*Fury*," showing how the increased boiler demands have been satisfied without any sacrifice in outward appearance.

coupling rods, etc., conform to the standard type on the L.N.E.R. "Pacific" locomotives. Walschaerts valve gear is fitted to the outside cylinders, and the valves of the high-pressure cylinders are actuated by a rocking shaft in such a manner that the cut-off of the high-pressure cylinders can be varied independently of that of the low-pressure cylinders. An important feature of the design is that the whole of the air supplied to the firegrate is pre-heated, the supply being taken from the front of the smokebox, and passing down a space between the boiler and the casings.

A further interesting point about this locomotive is that it possesses the 4–6–4 or "Baltic" type wheel arrangement. "Baltic" tank engines are in use by the London Midland and Scottish and the Southern railways, but this is the first tender locomotive with this wheel arrangement to be constructed and operated in this country. The six coupled driving wheels are 6 ft. 8 in. in diameter. The tender is of the L.N.E.R. "*Flying Scotsman*" corridor type, and the total weight of engine and tender in working order is 166 tons.

"No. 10000" has been constructed to the designs and inventions of Mr. H. N. Gresley, C.B.E., Chief Mechanical Engineer of the London and North Eastern Railway Company. It has been built with the object of achieving higher all-round efficiency and fuel economy. After its preliminary trials the locomotive will be tested in actual service between London, King's Cross, and Edinburgh, Waverley.



Courtesy [*L.N.E.R.*

A front view of the L.N.E.R. locomotive "No. 10000." The chimney has had to be sunk within casing plates.

Closely following upon Mr. Gresley's engine came the London Midland and Scottish high-pressure locomotive, No. 6399, "*Fury*." While this locomotive is less unorthodox in outward appearance than the L.N.E.R. "No. 10000," it is perhaps even more interesting in that it is fitted with a boiler designed on the Schmidt high-pressure system. It has been built by the North British Locomotive Company, Glasgow, under the supervision of Sir Henry Fowler, K.B.E., Chief Mechanical Engineer of the London Midland and Scottish Railway, in conjunction with the Superheater Company Ltd., London.

The design of the "*Fury*" follows that of the "Royal Scot" class with regard to the frame, but in this case the engine is a three-cylinder compound, the high-pressure cylinder being situated between the frames and the two low-pressure cylinders outside the frames. The design of the boiler is based upon that of the experimental Schmidt boiler that was built for one of the Continental railways, and which passed through a series of severe trials with complete success.

The Schmidt high-pressure boiler consists of three distinct systems or boilers, each carrying a different pressure. The system having the highest pressure—1,400 lb. to 1,800 lb. per sq. in., the variation in pressure depending upon the rate of firing—is in the form of a "closed circuit" consisting of a number of pipes that form the sides, roof, and back end of the firebox. These pipes are connected at the bottom to a foundation ring and at the top to equalising drums, into which they are expanded. From the equalising drums pipes are led to evaporating elements situated in the high-pressure drum. This closed circuit is initially filled to a predetermined level with pure water, and this latter is the medium by means of which heat is transmitted from the firebox to the evaporating elements in the high-pressure drum. This drum furnishes steam at 900 lb. per sq. in. for the high-pressure cylinder of the locomotive. The drum is of nickel steel, but is not in any way in contact with the fire. It is fed by water drawn as required from the low-pressure boiler by means of a pump.

The low-pressure boiler occupies the same position as the barrel of the normal locomotive boiler, and the water is evaporated by the gases passing through the boiler tubes. The barrel of this low-pressure boiler also is of nickel steel, but both tube plates are of mild steel.

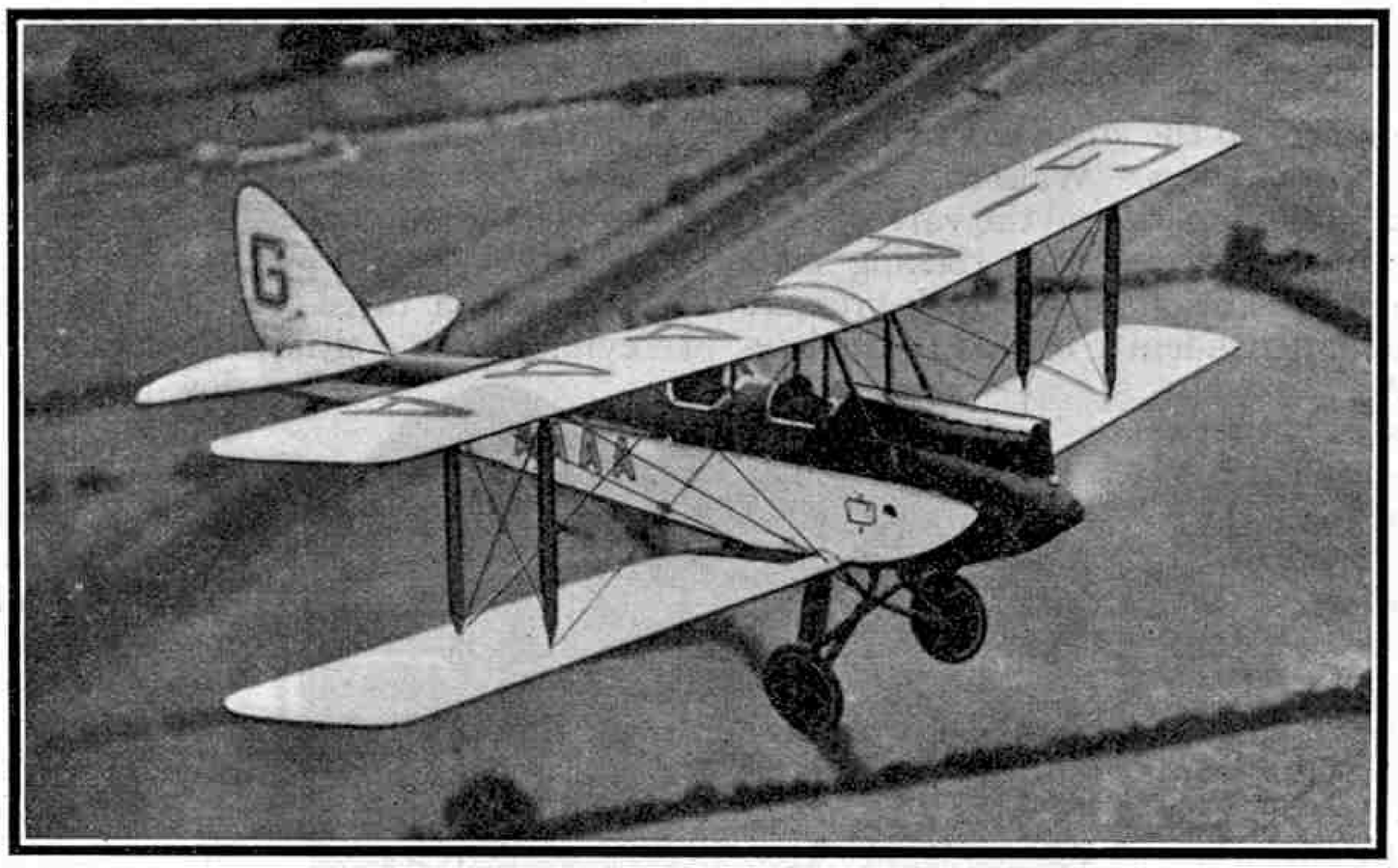
An ordinary live steam injector is provided on the driver's side and an exhaust steam (*Continued on page 92*)

Famous Aero Engines

XI.—The de Havilland "Gipsy"

THE de Havilland "Gipsy" engine was designed jointly by Major F. B. Halford, F.R.Ae.S., and Captain Geoffrey de Havilland, specially for use in light aircraft of the "Moth" type, and its story is largely that of the "Moth" aeroplane. It is interesting to note that previously the "Moths" had been equipped with the well-known A.D.C. "Cirrus" engine, which also was designed by Major Halford in collaboration with Captain de Havilland.

The first engines of the "Gipsy" series, developing 135 h.p., were produced in June, 1927, and were subjected to a series of severe tests. One was installed in a "Tiger Moth" single-seater experimental monoplane, and in this machine Captain H. S. Broad, A.F.C., the de Havilland Company's chief test pilot, set up a new world's speed record for light aeroplanes of 186.474 m.p.h., on 24th August, 1927. This record still stands.



Courtesy [*De Havilland Aircraft Co. Ltd.*

Captain G. de Havilland's privately-owned "Gipsy Moth," on a cross-country flight.

When the preliminary tests had been completed the engines were "de-tuned" to give only 100 h.p., in order to ensure greater reliability and longer life in normal service. After being de-tuned the engines were run for a total of approximately 1,000 hours' flying time. In March, 1928, a "Gipsy" engine running on undoped No. 1 commercial petrol successfully passed the Air Ministry official type test on its second attempt. This was the first occasion on which any engine successfully completed this test without the use of specially doped petrol.

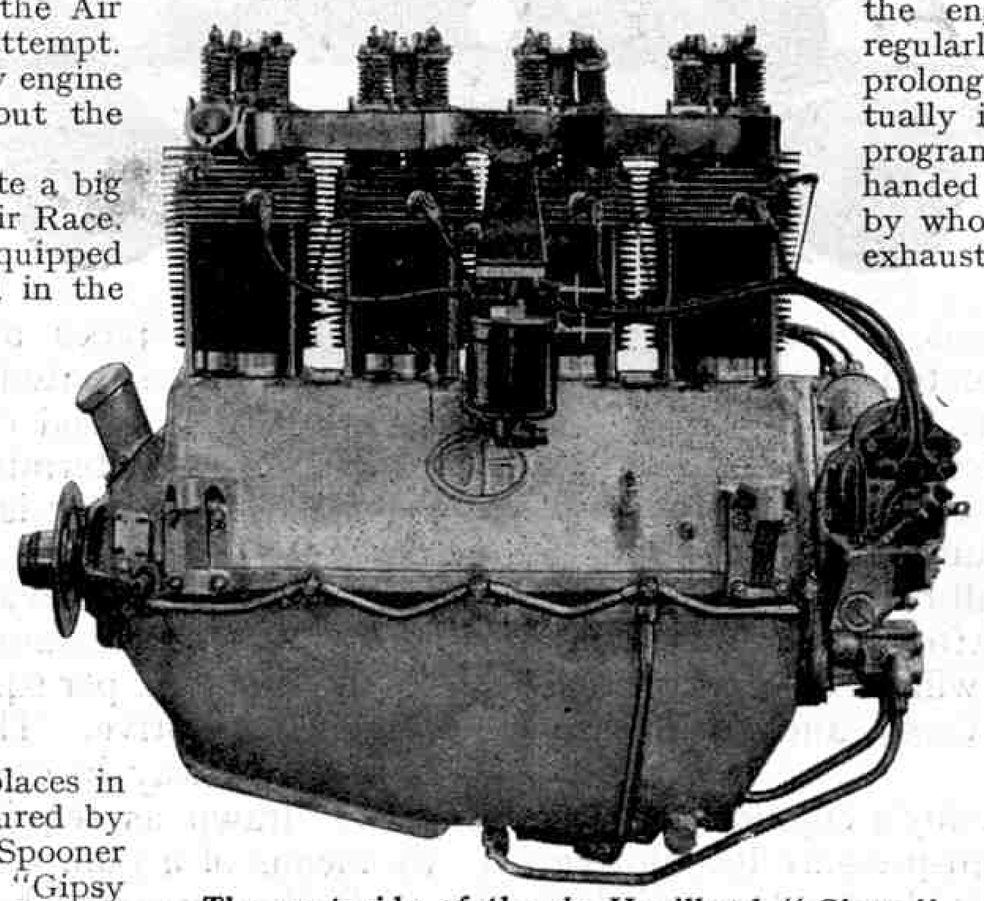
The "Gipsy" engine has played quite a big part in the history of the King's Cup Air Race. In 1928 three "Moth" machines equipped with this type of engine were entered in the event. Each of the machines completed the course, and one of them, piloted by Captain W. L. Hope, was the winner. Captain Hope's average flying speed over the complete course was 100.75 m.p.h. The other two machines, piloted by Captain H. S. Broad, and Mr. A. S. Butler, Chairman of the de Havilland Aircraft Co. Ltd., finished fourth and sixth respectively. In addition to this success Mr. Butler secured the second prize in the Siddeley Trophy Race.

In 1929 the third, fourth and fifth places in the race for the King's Cup were secured by Captain Hope, Mr. Butler, and Miss W. Spooner respectively, each piloting a standard "Gipsy Moth" machine. The performance of these engines in the contest for the Siddeley Trophy was even more noteworthy, for five out of the first six places were secured by pilots of "Gipsy Moths." Mr. Butler set up the fastest time for light aircraft.

An unofficial endurance record for light aeroplanes was set up in August, 1928, by Captain Broad, who remained aloft in a "Gipsy Moth" for 24 hours. A practical demonstration of the inherent stability of the "Moth" aeroplane was provided by the fact that Captain Broad read three novels during the flight! The total petrol consumption of the "Gipsy" engine for the 24 hours was only about 66 gallons, while 1¼ gallons of oil were used. It has been calculated that the crankshaft of the engine made 2,500,000 revolutions, and that the two magnetos produced a total of 20,000,000 sparks! At the completion of the flight the engine was still functioning perfectly.

A very remarkable demonstration of the reliability of the modern aero-engine was commenced on 27th December, 1928, when a standard "Gipsy" engine was selected from stock by representatives of the Air Ministry Aeronautical Inspection Directorate. The engine was then sealed in such a manner that any repairs or modifications, other than routine checking of valve clearances and the cleaning of sparking plugs and filters, etc., could not be carried out without breaking the seals. The engine was then fitted into a standard "Moth" aeroplane, G–EBTD, with the object of endeavouring to complete a period of 600 hours' flying time without overhauling the engine.

At the completion of the pre-arranged time it was found that the engine was running so smoothly and regularly that the promoters were tempted to prolong the test for another 400 hours. Eventually it was decided to keep to the original programme, however, and the engine was handed over to representatives of the A.I.D. by whom it was stripped and subjected to an exhaustive examination.



The port side of the de Havilland "Gipsy" engine. The cleanness of design, together with the accessibility of the magneto, make the engine popular with owner-pilots.

The actual total running time of the engine, including bench tests, taxying, and running up, was 661 hours 5 minutes, during which the total distance covered in the air was 51,000 miles. Throughout the trial the cruising speed of the "Moth" was kept as far as possible at about 85 m.p.h., and the total consumption of petrol was approximately 2,970 gallons—4½ gallons per hour or 19½ miles per gallon. The oil consumption was .45 pint per hour, equal to 1,400 miles per gallon. The cost of petrol and oil was one penny per mile flown!

On three occasions the engine was submitted to bench tests on Heenan and Froude apparatus, a description of which will be published in a forthcoming issue of the *"M.M."* The first of the bench tests was carried out when the engine was new; the second after 500 flying hours, and the final one at the completion of the 600 hours. The second test revealed the astonishing fact that, although the engine had not been decarbonised, or the valves ground in, the output at 2,050 r.p.m. had dropped by only 2 h.p.

During the final test it was found that a further drop of less than 1 h.p. only had taken place since the previous test.

The result of the Air Ministry examination showed that the engine was in remarkably good condition, and the carbon deposit inside the cylinder heads and in the crowns of the pistons was less than twelve thousandths of an inch in thickness!

The "Gipsy" engine is of the four-cylinder-in-line air-cooled type. The cylinders are of cast-iron, deeply spigotted into the crankcase to ensure rigidity, and are each fitted with detachable aluminium cylinder heads that are in turn each equipped with one inlet and one exhaust valve. The valve seatings are of bronze, screwed and expanded into position. Two sparking plugs are fitted to each cylinder. The plugs screw into bronze adapters, thus obviating possible trouble with damaged threads in the head casting, due to their removal. Both the cylinders and the cylinder heads have a very large fin area, arranged particularly to suit the method of cooling adopted on the "Moth." Owing to the fact that both the inlet and the exhaust port have been located on the port side, the slip-stream from the propeller is effective in carrying any fumes clear of the cockpits.

The pistons are of the "slipper" type, cast in aluminium alloy and so designed that the load from the flat crown is taken direct to the gudgeon pin bosses and not to the skirt. The gudgeon pins, which float in both the piston and the small end of the connecting rod, are secured at each end by external circlips and washers, and are splash lubricated through holes in piston bosses and connecting rod small end bearings. Three rings are fitted to each piston above the gudgeon pin bosses, the lowest ring being of the "scraper" type. This feature contributes to the very low oil consumption characteristic of the engine.

The camshaft is of large diameter carrying eight cams and is mounted in five plain bearings in the upper section of the crankcase. It is exposed to the oil mist in the crankcase, which provides ample lubrication. Long life of cams and tappets is ensured by the employment of exceptionally wide contact surfaces.

The valves are operated by rockers through duralumin tubular push rods having hardened steel ball-and-socket joints at both ends. The adjustment is simple and accessible, being arranged on the rockers and effected by means of two small spanners. Valve timing is facilitated by the registering of a pointer on the propeller boss with the required marking on the front cover of the crankcase. The rockers are mounted on a rigid steel bracket bolted to the cylinder heads, and oscillate on phosphor bronze bushes. The ends of the valve stems are fitted with hardened steel thimbles to reduce to a minimum the wear between the valve rocker end and the valve stem.

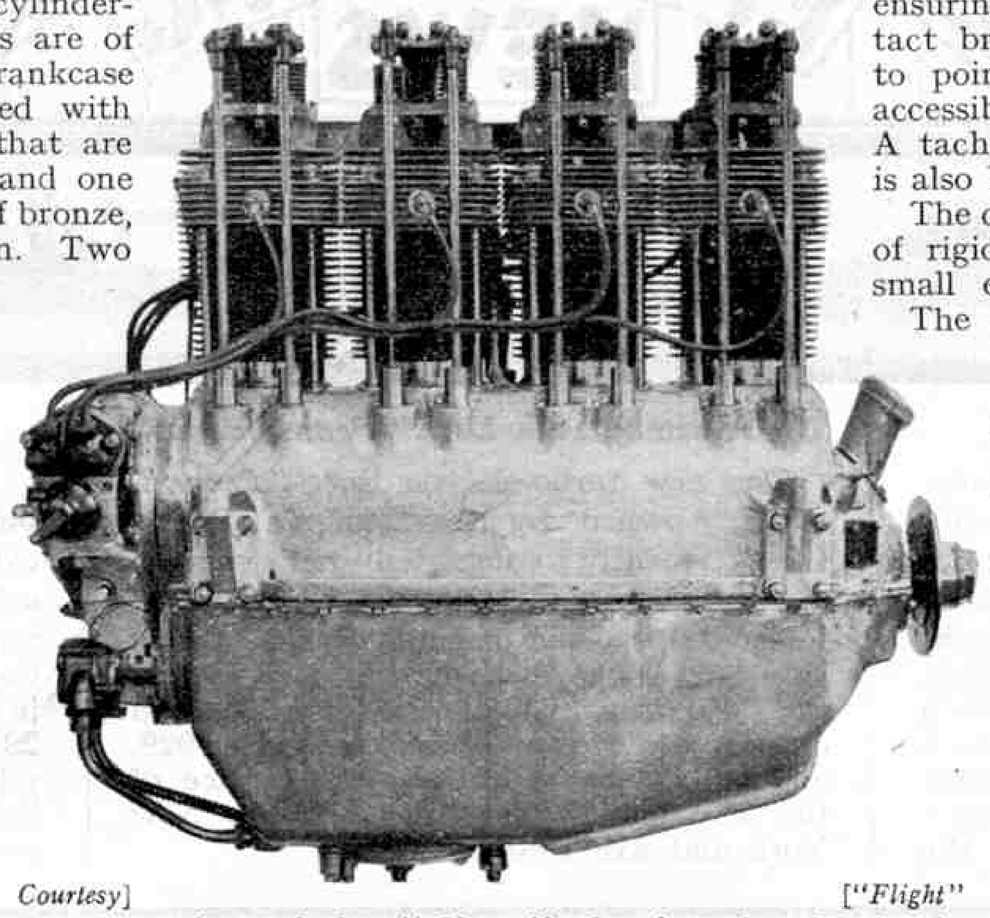
The timing gears are located at the rear of the engine and housed in a separate cover. The camshaft is driven by spur gears from the crankshaft, which is an exceedingly stiff one-piece forging, carried in five strongly supported plain bearings. A vernier coupling is provided between the gear wheel and the camshaft flange, thus permitting a very fine adjustment to valve timing. The two magnetos are mounted crosswise on sturdy platforms cast integral with the timing cover, and are driven through special "Simms" flexible vernier couplings.

Easy starting is facilitated by the use of an impulse starter fitted to one of the magnetos. This device causes the magneto to deliver a strong spark at slow revolutions of the engine, thus ensuring ignition of the mixture. The contact breakers and distributors are arranged to point outward in order to make them accessible for adjustment and inspection. A tachometer reduction gear box and drive is also built into the timing.

The connecting rods are "Y" alloy forgings of rigid construction, having both big and small ends of exceptionally robust design.

The crankcase is constructed of an aluminium alloy casting, carrying the five main crankshaft bearings, which are held in position by separate caps, thus facilitating assembly, overhaul and inspection. Oil filler cap, breathers, engine bearer facing, etc., are provided on this component.

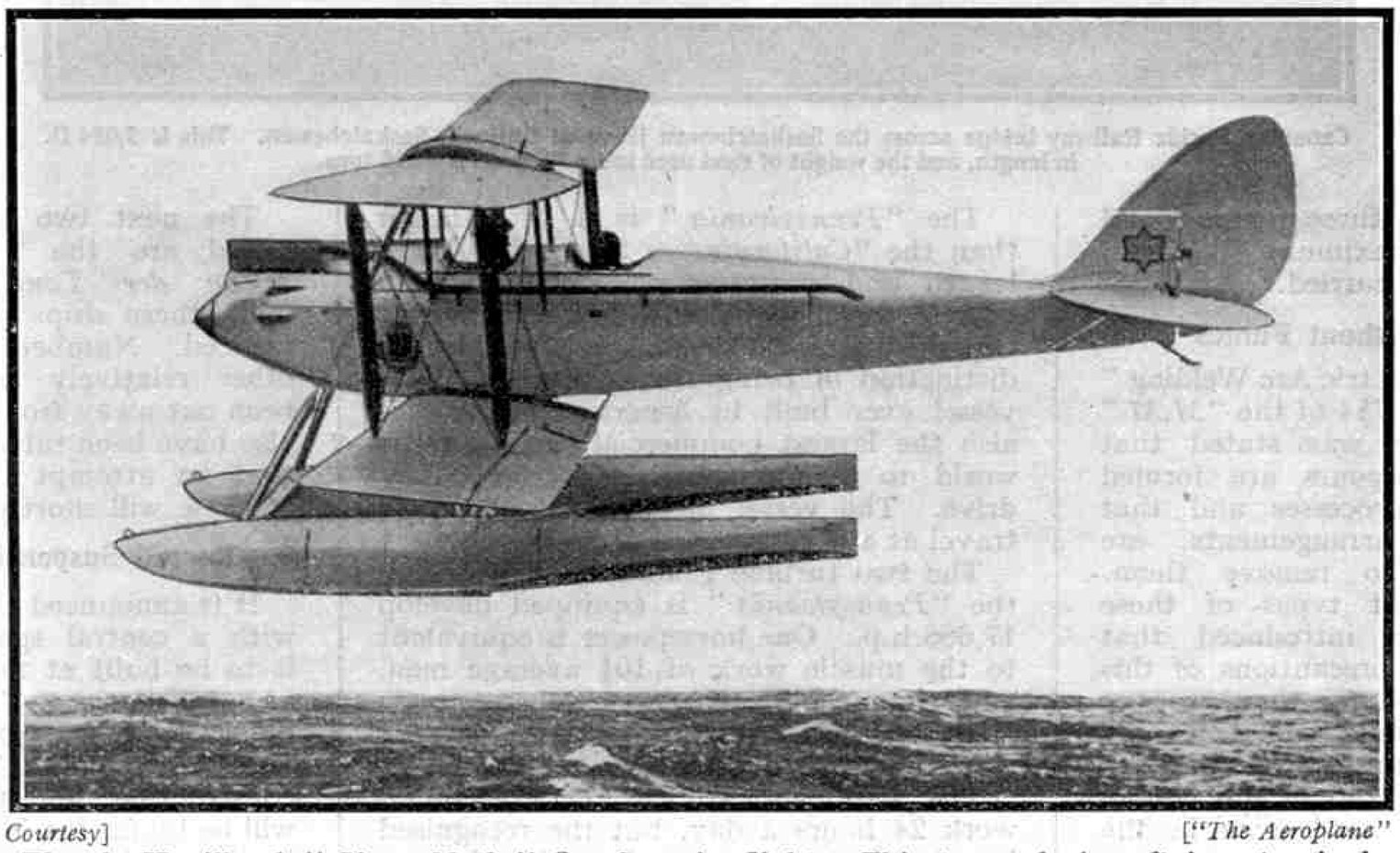
The mixture is obtained from a "Zenith" 48 R.B. type carburetter situated on the centre of the port side of the engine with the float chamber outboard, so that the petrol level is unaffected by the attitude of the machine when climbing or gliding. This position in relation to the position of the magnetos reduces the risk of fire to a minimum. The portion of the steel induction manifold immediately above the carburetter is jacketted and heated by the exhaust manifold, which is conveniently close, thus ensuring efficient carburation.



Courtesy] ["*Flight*"

Another view of the "Gipsy," showing the duralumin push rods that operate the valves.

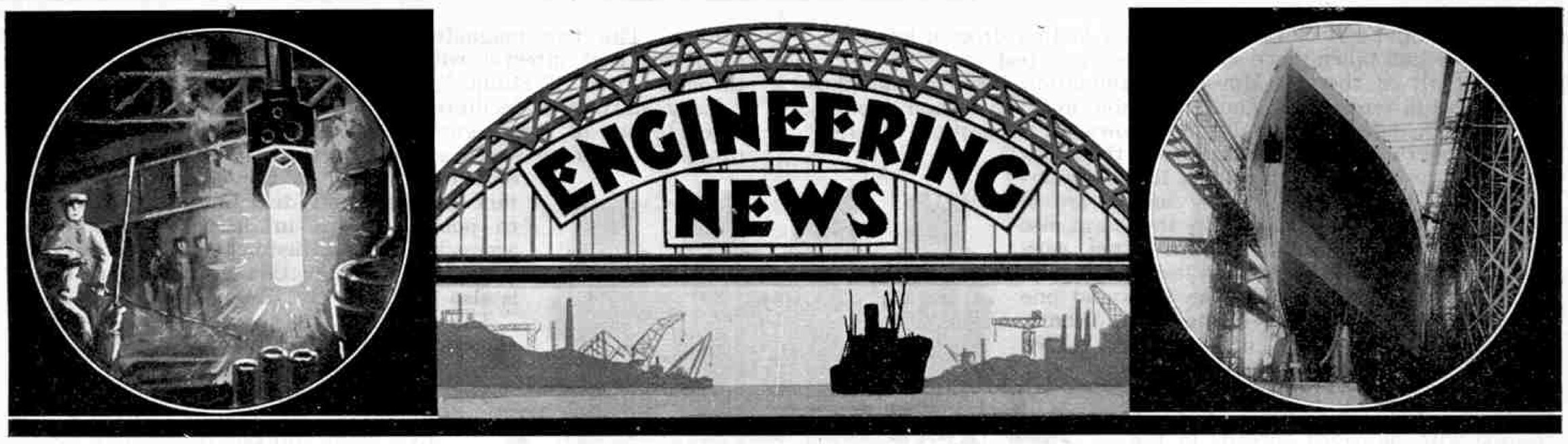
The lubrication system is very efficient. Oil is drawn from the crankcase sump by a gear type pump situated in the timing gear cover and driven by spur gearing from the crankshaft. From there the oil is passed through an adjustable pressure relief valve to the pressure oil filter; and from the lower part of this filter it is fed to an external gallery and thence through passages in the crankcase to each of the five main bearings. A small feed at the rear end of this gallery supplies the timing gears, a connection in this pipe being provided for the oil pressure gauge. From the main bearings oil is forced into the hollow crankpin and supplies the big-end bearings at a pressure of from 30 lb. to 40 lb. per sq. in. Piston lubrication is effected from special "leak" holes in the crankpin seats, and is therefore definite and does not vary with the amount of wear in the big-end bearings. Camshaft bearings, tappets and cams also benefit by the oil drawn from the crankshaft, the surplus passing through a gauze filter tray on its return to the sump. The supply of lubricant is replenished through a filler cap in an accessible position in the forward end of the crankcase, and the quantity of oil in the sump can readily be ascertained by the "dipper" rod provided.



Courtesy] ["*The Aeroplane*"

The de Havilland "Gipsy Moth" Seaplane in flight. This type of aircraft is extensively used in Canada for forestry fire patrol purposes.

The "Gipsy" engine has a bore of approximately $4\frac{1}{2}$ in., and a stroke of approximately $5\frac{1}{16}$ in. The capacity of the engine is 5,226 c.c., and its normal output is 90 h.p. at 1,900 r.p.m. Its maximum output is 100 h.p. at 2,100 r.p.m. The petrol consumption at 9/10 throttle at 1,900 r.p.m. is approximately $5\frac{1}{2}$ gallons per hour; and about 7 gallons per hour at full throttle at 2,100 r.p.m. The oil consumption is about $\frac{1}{2}$ pint per hour.



New Electric Delivery Van

When frequent stops have to be made, a delivery van propelled by an internal combustion engine is not the most economical of vehicles, and a new type of electrically-propelled vehicle has recently been constructed especially for this kind of work. In outward appearance this resembles a petrol vehicle, but the internal disposition of the mechanism is entirely different. The motor is situated at about the centre of the chassis, and is connected to the rear driving wheels by a tubular propeller shaft and worm gearing, while the accumulators that supply current are carried under the bonnet.

The wheel base of the vehicle is 10 ft. 3 in. in length and the track is 4 ft. 8 in. in width. The batteries provide sufficient energy for a straight non-stop run of 27-30 miles, and for a round of about 18 miles when approximately 100 stops are made. The maximum speed is 12 m.p.h., and an interesting feature is that the vehicle is fitted with six speeds, three forward and three reverse. A maximum load of about one ton may be carried.

Arc Welding Without Fumes

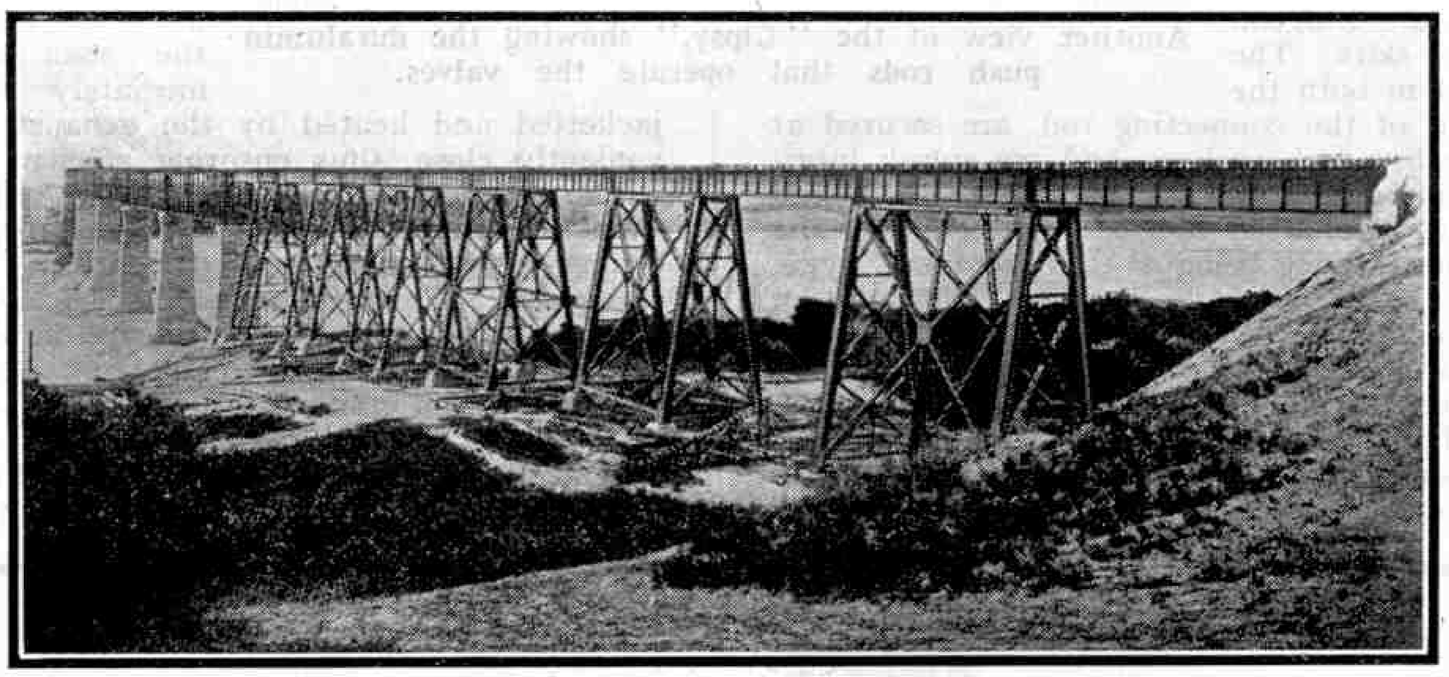
In the article on " Electric Arc Welding " that appeared on page 754 of the "*M.M.*" for October, 1929, it was stated that dangerous metallic vapours are formed during arc welding processes and that special ventilating arrangements are necessary in order to remove them. Recently more efficient types of these electrodes have been introduced that have rendered special precautions of this type quite unnecessary, for they produce no harmful fumes of any kind. To-day the average electrodes made by well-known firms in Great Britain and in the United States may be safely used even in the most confined spaces.

Underground Cable System for France

A long new underground telephone cable, that has cost approximately £1,520,000, has been laid between Paris and Bordeaux, a distance of about 335 miles. The cable is laid underground for the whole of this distance, and is the first stage of a great national scheme which is to provide for the linking of Paris, Lyons and Marseilles in a similar manner.

The Panama Pacific Liner "*Pennsylvania*"

The new turbo-electric liner "*Pennsylvania,*" owned by the Panama Pacific Line, recently completed her maiden voyage between New York and San Francisco via the Panama Canal. The ship is a sister-vessel of the "*California*" and "*Virginia,*" which were fully described on page 514 of the "*M.M.*" for July, 1929, and will share with them the service of the Panama Pacific Line between New York and San Francisco.



Canadian Pacific Railway bridge across the Saskatchewan River at Outlook, Saskatchewan. This is 3,004 ft. in length, and the weight of steel used in its 27 spans is 2,516 tons.

The "*Pennsylvania*" is a little larger than the "*California.*" She is 613 ft. in length and possesses a displacement of 33,375 tons, while the tonnage of the earlier vessel is 30,230. This gives her the distinction of being the largest merchant vessel ever built in America, and she is also the largest commercial vessel in the world to be propelled by turbo-electric drive. The vessel has been designed to travel at a normal speed of 18 knots.

The two turbine generators with which the "*Pennsylvania*" is equipped develop 17,688 h.p. One horsepower is equivalent to the muscle work of 10½ average men, and thus the horse-power generated on board the ship is equivalent to 185,724 man power.

The giant engines of the "*Pennsylvania*" work 24 hours a day, but the recognised length of the working day of a human being is only 8 hours. On this basis, therefore, the vessel's turbines are equivalent to 557,172 men. Assuming that one-third of the population of a large city consists of able-bodied men, this leads us to the surprising conclusion that the power required to drive the "*Pennsylvania*" is equal to the total man power of a city twice the size of Liverpool and is only just under half that of the whole of the Chilian Republic in South America!

Progress at Scapa Flow

In spite of the very bad weather and boisterous gales that have recently been experienced in many parts of the world, salvage operations at Scapa Flow have not been hindered to any great extent. Cox and Danks Ltd., the salvage engineers in charge of operations, have now raised 29 vessels, the most recent one to be salvaged being the 4,000 ton ex-German light cruiser "*Bremse,*" which was scuppered at one of the most exposed positions in the Flow.

The "*Bremse*" was refloated some months ago, but during a spell of bad weather she was forced over on her side and it was only by the use of new compressed air apparatus that the engineers were able to restore her to a fairly even keel. The vessel also had to be fitted with a number of new airlocks to enable the 10-mile journey from the Flow to Lyness to be undertaken in safety. During this voyage the vessel had a slight list of about seven degrees.

The next two vessels that are to be raised are the "*Hindenberg*" and the "*Von der Tann.*" Preliminary work upon these ships already has been commenced. Numbers of gun turrets and other relatively small parts that have been cut away from vessels already raised, also have been salvaged, and it is probable that an attempt to raise the remainder of these will shortly be made.

Record Suspension Bridge Planned

It is announced that a suspension bridge with a central span 4,100 ft. in length is to be built at the entrance to the Bay of San Francisco. The span will be 600 ft. longer than that of the bridge across the Hudson River at New York now under construction, and the proposed structure will be by far the longest suspension bridge in the world. The central portion of the bridge will span the navigation channel of the river, and give a vertical clearance above high water level of 162 ft.

The cost of erection of the bridge is estimated at £6,000,000. This is much less than the £20,000,000 to be expended on the Hudson River Bridge, and the difference is accounted for by the fact that the bridge at San Francisco will be used for road traffic only, no accommodation being provided for railway tracks.

New Turbine Steamer for Channel Islands Service

During recent years there has been an enormous increase of passenger traffic between Southampton and the Channel Islands and in 1929 the steamships of the Southern Railway carried 17,000 more passengers than in 1928. In consequence it was decided to build two new vessels for operation on this route, and their construction was entrusted to William Denny & Bros. Ltd., of Dumbarton.

The first of these ships, the "*Isle of Jersey*," was launched on 22nd October, 1928, and her sister vessel, the "*Isle of Guernsey*," has now been completed. This vessel is 306 ft. in length and 42 ft. in breadth. She has accommodation for a maximum of 1,400 passengers. The public rooms are handsomely decorated and luxuriously equipped, and special attention has been paid to heating and ventilation, which are carried out on the most modern "Thermo-tank" system. An interesting feature of both vessels is that the accommodation for second-class passengers has been increased, so that it now amounts to 50 per cent. of the total available space.

A Marconi wireless telegraphy installation is carried, together with a direction finder and an auto alarm. The ship is propelled by two sets of Parsons' geared turbines, driven by steam supplied by boilers working under a pressure of 200 lb. per square inch, and arranged to burn oil fuel under the closed stokehold-system of forced draught.

River Mersey to be Roofed In?

A somewhat unusual scheme for the covering-in of a river has been put forward at Stockport, Cheshire. Stockport is a manufacturing town of some 123,500 inhabitants, and is situated near the source of the River Mersey, which flows through the centre of the town. It has been suggested that the Mersey should be covered in for a distance of about a quarter of a mile, and that a wide road and numerous roomy shops should be erected on the roof.

The estimated cost of the scheme is between £250,000 and £300,000, and the Corporation have decided to apply to Parliament for permission to proceed with the work early in this year.

Experimental Concrete Roadway

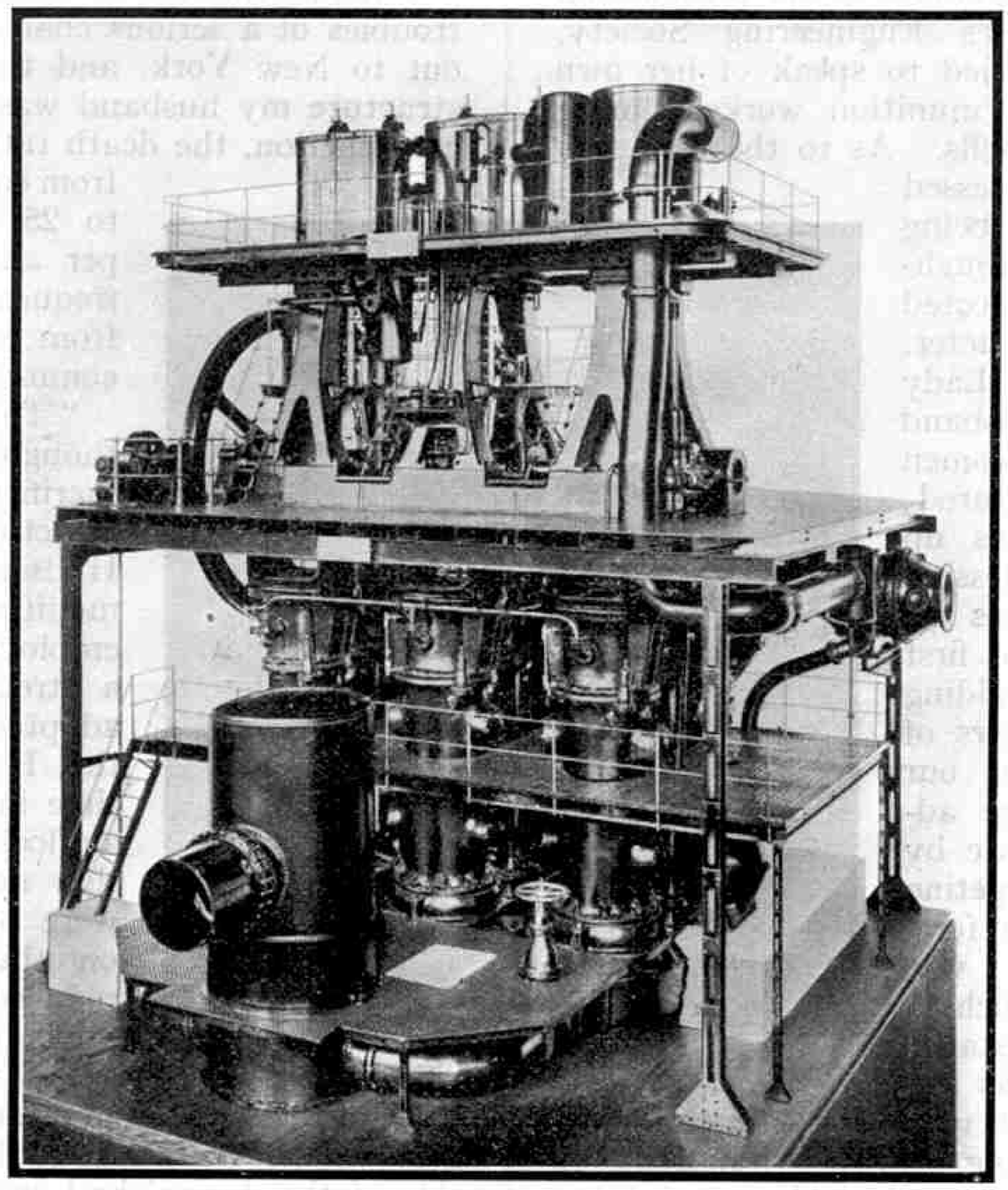
An interesting experiment is now being carried out by the Ministry of Transport, who have constructed a concrete road 600 yards in length, between Slough and Hounslow, in the South of England. The road is 20 ft. in breadth, and has been laid in order to obtain data relating to the wearing powers of concrete for such purposes.

The experimental stretch is on a fairly busy by-pass road, and in order to ensure that it receives the maximum amount of use, a part of the main road has been closed, thus ensuring that all traffic takes the new road.

Giant Cooling Towers 210 ft. in Height

Recently a large power station at Birmingham was opened by the Duke and Duchess of York. This is one of the principal stations constructed in accordance with the schemes of the Central Electricity Board. When finished it will be one of the largest in Great Britain and will develop a maximum of 480,000 k.w. during every 12 hours.

It is interesting to note that the two cooling towers of the new station are the tallest of the kind in this country. Each is 210 ft. in height, and between them the towers are capable of dealing with no less than 5,000,000 gallons of cooling water per hour.



The accompanying photograph, which is published by courtesy of Messrs. Demag, shows a model of a pumping installation that has been working at Hattersheim near Frankfurt for over a year. The full-sized apparatus consists of three differential pumps and is capable of raising over five million tons of water a day. This working model was exhibited at the Barcelona Exhibition.

Interesting Marine Engine Conversion

In view of the rivalry between Diesel engines, turbines, and reciprocating steam engines as means of propulsion for ships, it is interesting to learn that the "*La Marca*," a vessel owned by the United Fruit Company, is to be converted from the Diesel-electric system to turbo-electric drive. The United Fruit Company have already had much experience of vessels driven in this manner, the first electrically driven ship, the "*San Benito*," having been built for them as long ago as 1921. The "*La Marca*" is the first vessel to be treated in this way, and consequently a great interest in the work is being taken by marine engineers all over the world.

While the change-over is being carried out, the "*La Marca*" is also to be lengthened. When in dock she will be cut in two, the halves separated, and then rejoined by additional plates.

Electricity Consumption for 1928

According to the Annual Returns of the Electricity Commission that have just been issued, 564 power stations were in operation in Great Britain during the year ending 31st March, 1929. The total power generated by these stations was 10,878,980,925 k.w.h., which necessitated the consumption of 9,562,109 tons of coal, coke and oil. The power generated shows an increase over that for the previous year of 9.58 per cent., but the increase in fuel consumption was only 3.66 per cent.

Many of the 564 stations in operation were used only for generating power on a small scale for local use, more than 50 per cent. of the total power generated being provided by 33 main stations. The most productive of these stations was Barking, where 400,500,000 k.w.h. were generated. The next greatest output was generated at Barton, this station providing 359,600,000 k.w.h., and there were five other stations each of which generated more than 250,000,000 k.w.h.

The most efficient station was that at Padiham, near Burnley. This is owned by the Lancashire Electric Power Company, and has the record low coal consumption of 1.33 lb. per unit generated, and a thermal efficiency of 21.35 per cent. The total amount of power generated by this station was 67,000,000 k.w.h.

Large Australian Power Station

One of the largest power stations in the world to employ oil engines as prime movers is to be built near Broken Hill, Australia. The station is to provide electric power and compressed air for the mining operations of three large firms that have amalgamated their resources.

The heavy oil engines to be used at this station will be four in number. They will drive six generators, each of which will develop 3,000 b.h.p. It is estimated that the station will cost £500,000, and it is gratifying to learn that, with the exception of the compressing plant, switch gear and small electrical accessories, the necessary machinery will be supplied by British firms.

Novel Electrical Garage

A novel electrically operated garage has been constructed by a well-known American firm of electrical engineers. The garage only occupies a ground space equal to that of a fairly small private lock-up garage, and may be built to any height. Inside, it consists of a set of endless chains, to which a number of platforms are attached. A driver wishing to park his motor car drives his machine to the garage and on to one of the platforms, when a lever is pulled, and the driver is given a check upon which is printed the number of the platform on which his car is parked. The platform then moves up to make room for the next vehicle.

When the car is required once again, the elevator is brought down to street level by pressing a button corresponding to the number on the check first received.

Women and Civil Engineering

Some Reminiscences of Lady Moir, O.B.E.

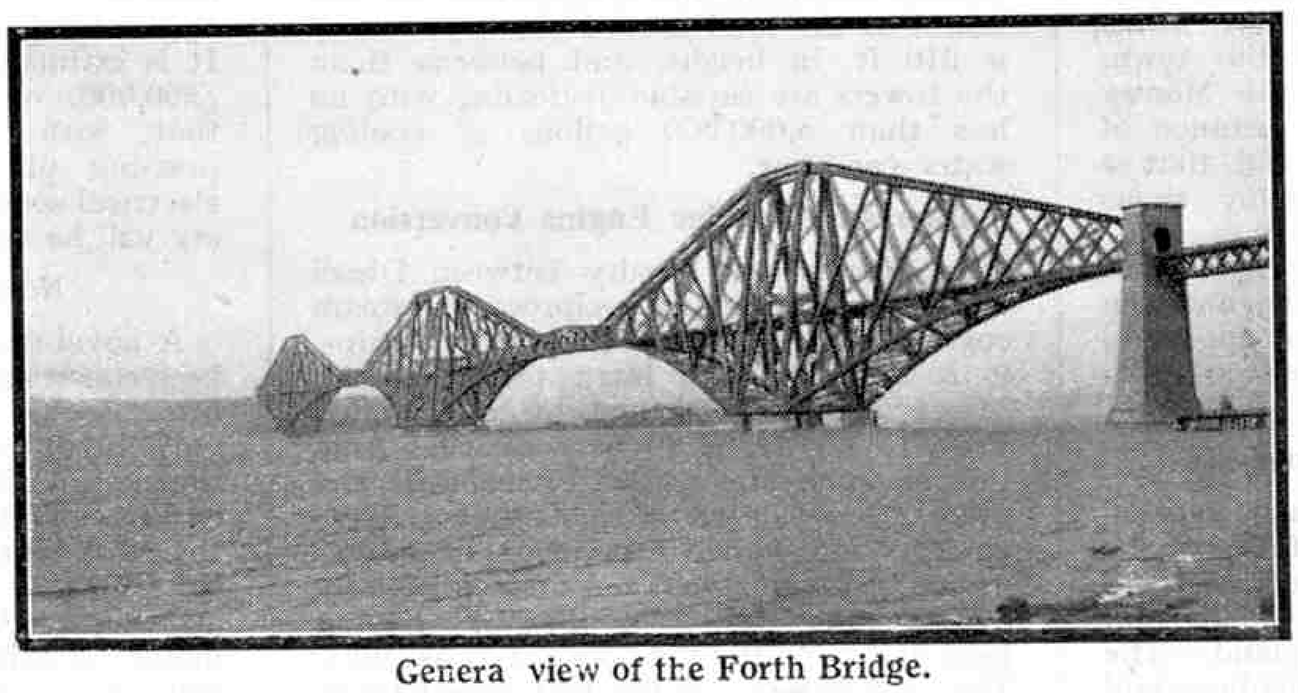
LADY MOIR, O.B.E., in the course of her presidential address to the Women's Engineering Society, said she was only qualified to speak of her own engineering experiences as a munition worker during the War on lathes turning shells. As to the rest, any engineering experience she possessed had been gained through being married to an engineer who throughout his career had been connected with works of the largest character.

"In many cases," said Lady Moir, "I have gone with my husband to places where, in the past, women would probably never have ventured; but every woman who takes up civil engineering as a profession will have similar experiences in the future. When we were first married my husband was building the southern pair of cantilevers of the Forth Bridge, and from our house I could see the bridge advancing in three sections, plate by plate, the three sections competing one against another. Therefore, from a bridge point of view, I was very familiar with what such a structure looked like from a distance while it was growing. I was frequently at the works, and it was very interesting to see the various sections being elevated hundreds of feet into the air to be put into place where they are now.

Lady Moir, O.B.E.

"Many a time bags of rivets or bolts would come hurtling from hundreds of feet like a rain of shells, striking first one part of the bridge and then another and dancing about like snowdrops in the wind; without any determined position on which they would drop, but if anyone were hit it meant serious injury or death.

"I frequently went down the caissons with my husband, and it was an interesting experience for girl friends and myself to descend the ladders, rung by rung, until we got on to the working floor, the sea and liquid mud being kept out entirely by air that was pumped continuously from above. I never had any ill-experience from so doing, though a great many people suffered from stoppage in the ears and consequent pain. But working in compressed air is one of the things that girl engineers will have to face.



Genera view of the Forth Bridge.

"While the Forth Bridge was relatively free from troubles of a serious character, later on when we went out to New York, and the Hudson Tunnel—the next structure my husband was connected with—was under construction, the death rate on this particular contract, from caisson disease alone, amounted to 25 per cent. of the employees per annum. Paralysis was very frequent and permanent injury from caisson disease was relatively common.

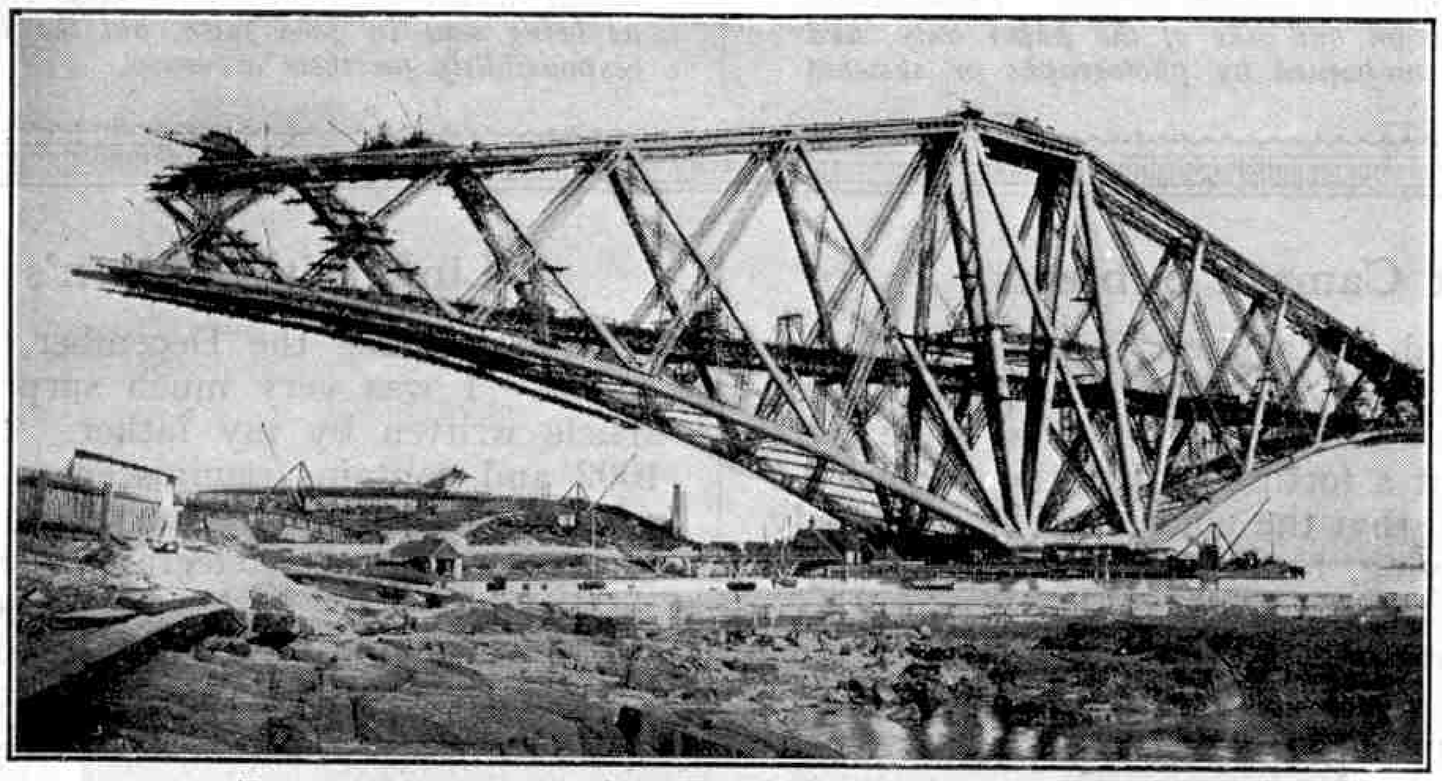
"This involved considerable thought as to how such terrible sacrifice made towards the construction of a tunnel under the Hudson in New York was to be modified in the interests of the employees. My husband introduced a treatment that is invariably adopted to-day and was used on the Hudson Tunnel for the first time in 1890. This was a medical air lock for the re-compression and slow de-compression of those who were overcome when they arrived on the surface. This speedily reduced the death rate from 25 per cent. to $1\frac{1}{2}$ per cent."

Lady Moir passed on to describe her first experience of American journalistic enterprise. The wooden partition of the caisson on the New York side of the tunnel had caught fire and the compressed air blew out through the hole, making it impossible to send in men to investigate. Her husband thought of sending in rats down the air delivery pipe with oakum tied to their tails, hoping that they would block up the hole. "However much this idea contributed to the blockage," said Lady Moir, "I am not prepared to say, but I know it was stopped up. My amazement on walking up Broadway and seeing the headlines of the papers on the side walks, '*Moir says rats*,' may well be imagined!"

The Hudson enterprise was shut down temporarily for financial reasons, and Lady Moir accompanied her husband to England where he was engaged in connection with the first tunnel driven under the Thames in the gravel of which a large portion of its foundation is composed. Here he introduced many safety devices, which were designed to ensure that if the river got in, the workmen would

be at least head and shoulders above water.

"Within six months," said Lady Moir, "a telephone message came through in the middle of the night saying that the river had broken into the tunnel, and I knew my husband's idea was going to be put to the test. The next few hours will always remain in my memory. What happened was that when he got to the bulkhead he found that the men were all out waiting for him. He asked for a volunteer, preferably unmarried. 'You are married yourself, sir,' said a voice, and the foremen stepped forward as one man to go with him. He chose one who had been one of his foremen in the Forth Bridge days, and when the door of the air chamber opened they stepped out from the air lock and went forward to the face and stopped up the steel protection shutters with clay."



The North Cantilever of the Forth Bridge during construction.

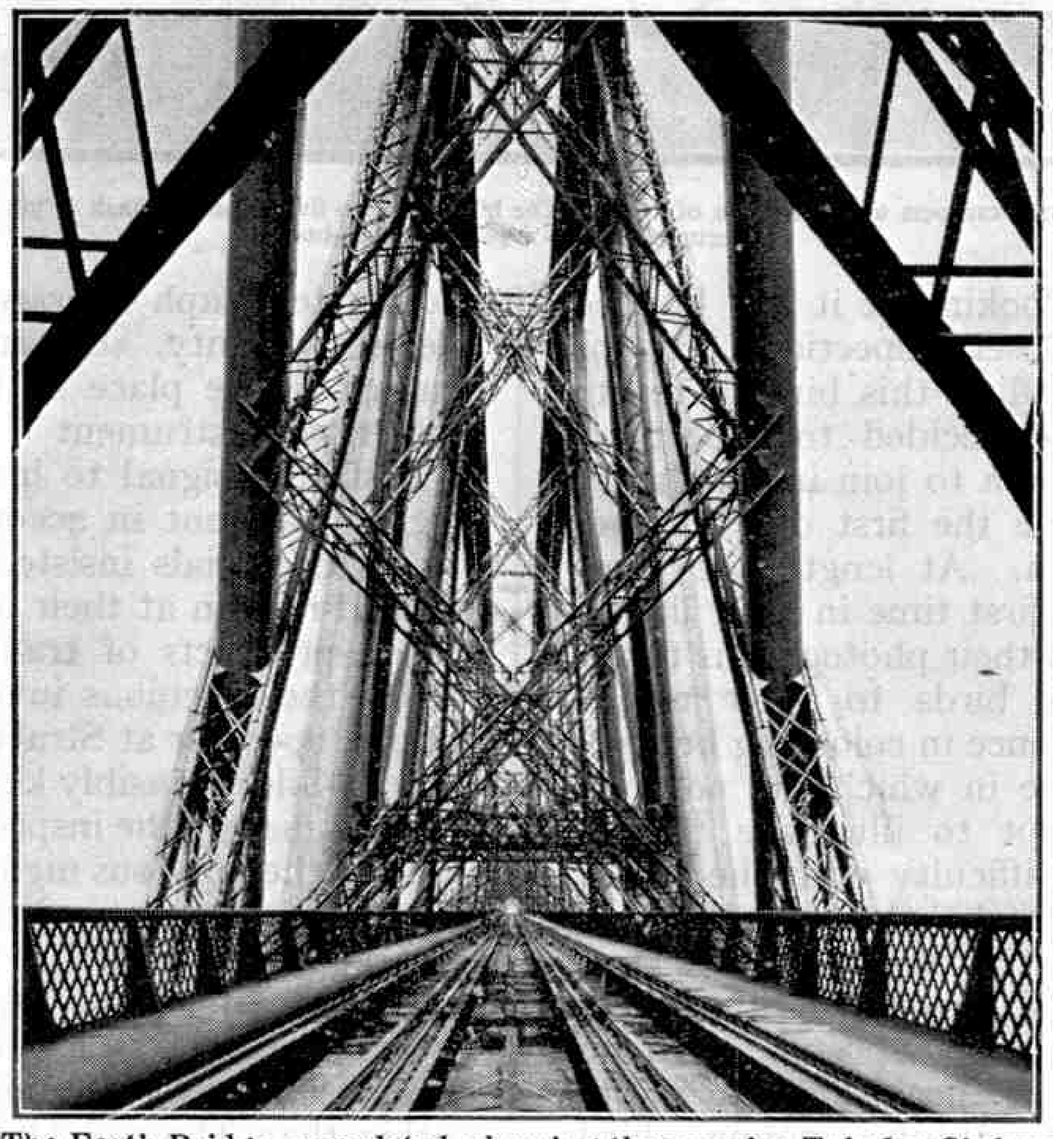
Lady Moir walked from Kent into Middlesex to take out the last plate in the side of the caisson on the Middlesex side of the river that prevented the passage from Blackwall Point into Poplar. Describing her experiences, she said: "I had to scramble up a ladder some 70 ft. suspended in the air and come out of the air lock on the Poplar side. I did not fully realise at the time that it was an undoubted risk and needed a very steady head to face it. However, looking back to such experiences now they seem to be in the nature of an unpleasant dream, the dangers of which I did not perhaps understand, and to the full extent of which I was certainly not informed."

Subsequently Lady Moir and her husband undertook some long trips into the interior of China, and she recalls that on one occasion they were in a house boat, 750 miles away from civilisation, and 17 days' journey into a trackless region, in connection with the building of a railway in Honan. This was a year after the Boxer Rising, and Lady Moir was the second white woman to enter that dangerous region.

Later Lady Moir accompanied her husband once more to America, in connection with the tunnels under the East River, constructed for the Pennsylvania Railway. The greater part of these tunnels was constructed through quicksand, overlying rock—a difficult and dangerous proposition. The scheme adopted in the Blackwall Tunnel of creating an artificial bed of clay was applied with equal success in this work over the top of the four tunnels. Very frequently these beds of clay could be seen throbbing owing to the pulsating of the quicksand underneath.

"Many days," said Lady Moir, "the East River could be seen spouting up like a geyser from an escape of air from the tunnels. If ever I wanted to feel depressed I used to take a trip on one of the ferry-boats to Long Island and listen to the remarks of the passengers as to what those fools of Englishmen were trying to do!"

Subsequent operations of which Lady Moir had personal experience were the works at Dover Harbour and the construction of the Royal Albert Dock, now called George the Fifth Dock. She describes an interesting fact in connection with the construction of this dock. An immense amount of pumping was required to drain the area, amounting at times to over 70,000,000 gallons a week; and for long distances round the area the subsoil was drained and peculiar settlements occurred. "There was a large sulphuric acid factory half a mile from the site, and the proprietor told my husband one day that he found his foundations under a cast iron column suspended from the floor above like a pendulum. My husband remarked that this was a matter of great scientific interest. It was clear that the floor above was sustained by force of habit, and had not discovered that it was suspending its own foundation!"



The Forth Bridge, completed, showing the massive Tubular Girders and the cross-bracings of Lattice-braced Girders.

Referring to the possibilities for women engineers Lady Moir said:

"We are, then, very dependent on the engineer as civilisation advances, for the greater refinements that crowds produce and that nations with vast populations demand, especially in the service of man. He utilises all the natural forces of nature for the benefit of those who come afterwards—that is the field of the engineer. The pioneer who goes out into the wilds thrusts a spear-head into unknown regions, and if women are going to follow on and take their place alongside, or with men, they (Continued on page 140

FROM OUR READERS

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Difficult Camera Subjects

Last spring I found in the nest of a pair of tree-creepers a newly hatched brood of young birds. At every opportunity I went out to see how these were progressing, and about a fortnight after the discovery I was astonished to find that the youngsters had suddenly become capable of flying, for as soon as I looked into the nest the five of them flew straight into my face!

Before I had recovered from the shock the birds had scattered, but with the help of a friend I succeeded in catching two of them in order to attempt to photograph them. I focussed my camera on a convenient branch of a tree and perched the young birds on it. Then the fun began. One of them seemed particularly interested in the strange machine that was looking at it and hopped on to the camera to make a closer inspection. By the time I had succeeded in persuading this bird to return to the branch the second one decided to collect his scattered brethren and bring them to join in the game; and when I went after this one the first one returned to its inspection of the camera. At length they condescended to pose, and for the first time in their lives—and possibly the last—they had their photographs taken.

Young tree-creepers on the branch of a tree. The birds were so lively that the task of posing them occupied nearly a quarter-of-an-hour.

When returning the young birds to their nest I noticed the remarkable resemblance in colouring between them and the trunk of the tree in which the nest was situated. I decided to attempt to illustrate this by a photograph and after some difficulty with the tripod, one of the legs of which had to be placed halfway up the trunk of the tree, I succeeded in getting a good exposure. Patience is necessary in photographing young birds in natural surroundings. But the hobby is fascinating and to secure such a photographas that of the young wren reproduced on this page is sufficient reward for almost any amount of trouble.

E. S. BAZLINTON
(Peterborough).

Baby hedge sparrow looks bored.

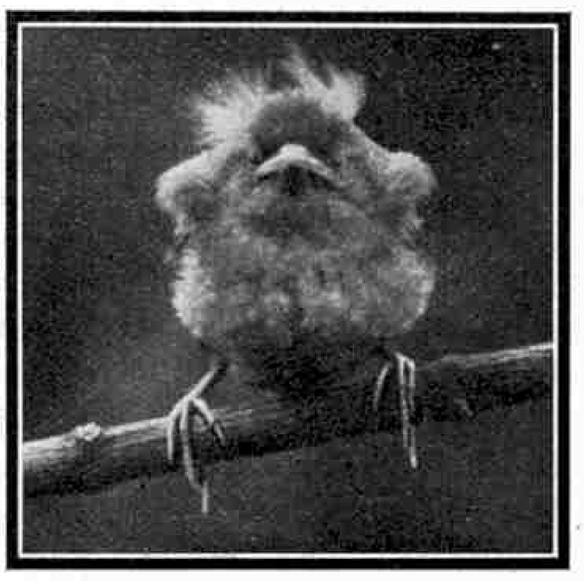
Link with Edison's Early Life

On purchasing the December, 1928, number of the "*M.M.*" I was very much surprised to find in it an article written by my father. This appears on page 1002 and contains reminiscences of the early days of railway working in Canada. When my father began his career as a railway telegraph operator he was only 13 years of age, and he found it necessary to stand on a box in order to reach the key of his transmitter.

It occurred to me that readers of the "*M.M.*" would be interested in an incident in which my father was concerned while still a young man. One night he was ordered to report without delay at Stratford, a small city about 100 miles west of Toronto, where he was to take the place of a young telegraph operator who had been discharged for neglect of duty. On arrival my father learnt that the culprit whose place he was taking had attached to the telegraph instrument a device that automatically sent the station signal to headquarters once an hour. This signal was sent in accordance with regulations, for the railroad officials insisted that night telegraph operators should remain at their instruments ready for work, even when prospects of traffic appeared to be non-existent.

By the ingenious invention fitted to his machine the young operator at Stratford succeeded in securing a good sleep while ostensibly keeping in touch with headquarters. Unfortunately the inspector had dropped in unexpectedly during the previous night and had found the inventor fast asleep at his post. Needless to say, he had been discharged immediately.

The man whose inventive genius had led to his dismissal was none other than Thomas Alva Edison, now famous as America's greatest inventor. When referring in later years to the incident, Mr. Edison always said that he resigned suddenly. There is no doubt that he did so, for he did not stay long enough to collect the



A young wren tries to appear important.

pay cheque that was due to him!

Many years afterward Mr. Edison revisited the spot as a guest of honour, and on that occasion the railway officials presented him with the cheque, which had been carefully preserved. The inventor received the slip of paper with his usual good humour and expressed his intention of having it framed!

R. S. DUNCAN (Toronto).

Illuminated Cross at Montreal

When Paul de Chomedy de Maisonneuve, the founder of Montreal, wished to commemorate this event, he erected a large cross on Mount Royal, the hill 700 ft. in height from which the city obtains its name. This was on 6th February, 1643, and to-day his cross is represented by a gigantic steel structure that has been erected on behalf of the National Society of French Canadians.

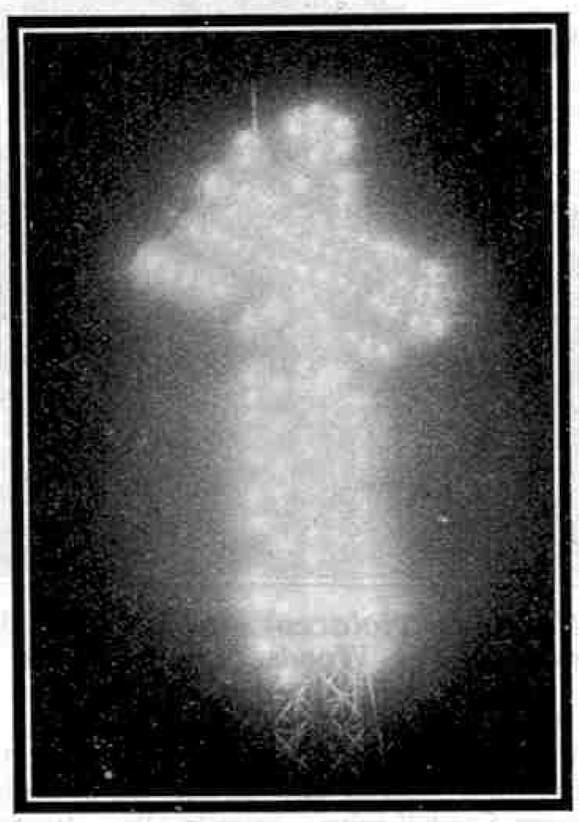
The cross is 130 ft. in height, and its width at the arms is 30 ft. It was erected by the Dominion Bridge Co. at a cost of more than £2,000, the greater portion of which was raised by the sale of a specially designed stamp. The original designs show a structure encased in stone or cement, and it was intended to instal passenger lifts to enable visitors to ascend to the apex of the cross. The heavy cost prevented these plans from being followed out.

By day and night the gigantic cross welcomes travellers approaching Montreal, for it is visible over a very great distance and at night is brightly illuminated by means of 240 lamps, each of 75 c.p. Owing to the severe nature of the winter climate it has been found necessary to enclose the lamps in glass containers. This has brought with it the drawback that the heat developed is not readily dissipated, and in consequence the lamps continually burn out, renewals taking place every day. Thus maintenance is a very costly item.

S. J. E. SLOAN (Montreal).

The steel cross on Mount Royal that commemorates the founding of the city of Montreal.

The "Titanic" afloat in New Zealand waters. This photograph was taken shortly before the vessel became a total wreck.



The Mount Royal cross illuminated by means of 240 lamps.

A Visit to a Lightship

While staying at Crail, a place on the coast of Fifeshire, I went for a trip in a small motor boat. Shortly after leaving the harbour we caught sight of a lightship station at this point, and as we approached the vessel her crew came on deck and made preparations to enable us to go on board. They were pleased to see us. This is not surprising, for it is very seldom that they have any visitors.

While on board we examined everything thoroughly. Some of us climbed the tower in which the light is situated, while others went below in order to inspect the engine room, where the machinery that causes the light to rotate was put into operation for their special benefit. The passage home again was distinctly unpleasant, for the sea had become comparatively rough, but the discomfort did not rob the trip of its interest and pleasure.

H. G. WHITE (Edinburgh).

The Cruise of the "*Titanic*"

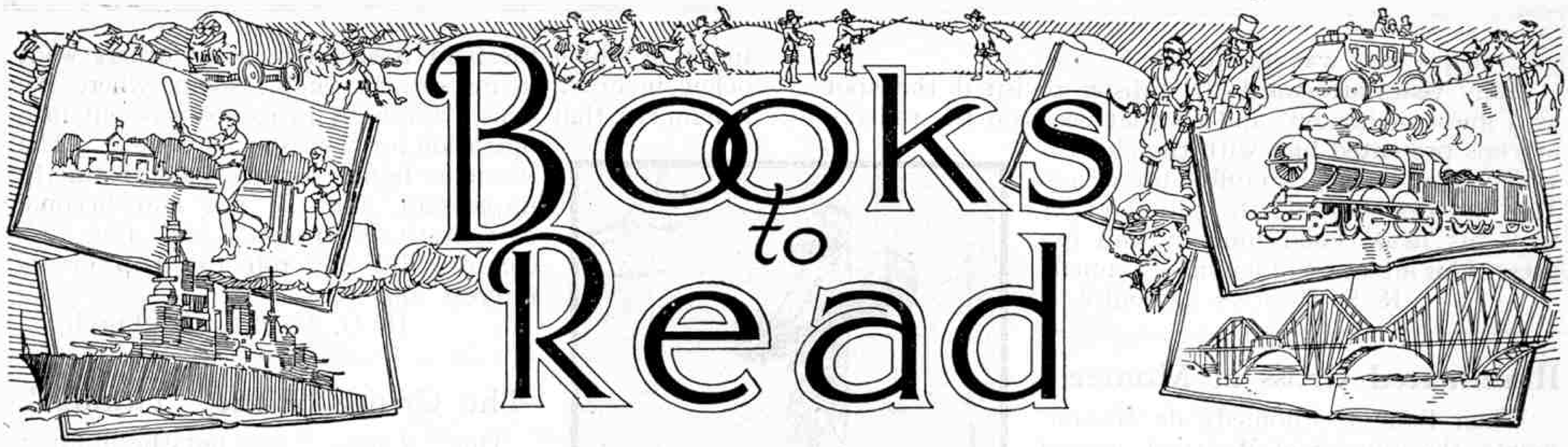
This "*Titanic*" was not the ill-fated giant trans-Atlantic steamship, but a liner constructed from a number of empty petrol tins! The idea of building her came to me on a glorious autumn day when I thought longingly of the pleasure of a row on the river. Unfortunately no boat was available, but on catching sight of a heap of discarded tins the bright idea of using them to build a vessel flashed across my mind.

I called a friend to my aid and we bound the tins together as firmly as possible into what we described as a boat. A better description would have been a raft or pontoon, for its shape left something to be desired! When completed we launched the vessel by the simple process of carrying her down to the river bank and dumping her into the water. We were so impressed by the enormous weight of our craft and the struggle we had to carry her the 200 yards that separated the "shipbuilding yard" from the river bank that we decided to christen her the "*Titanic*."

The honour of making the first voyage in our strange craft fell to myself. I stepped on deck and with a pair of roughly-fashioned oars propelled her across the sparkling water. After a short but highly enjoyable cruise I returned to port and allowed my friend to have a turn. We then tried to improve the vessel and after great efforts succeeded in providing her with a rudder and in fitting to it a mast and sail.

My friend and I enjoyed the fun immensely, but unfortunately the "*Titanic*" eventually came to an untimely end on one of my trips across the river. As I sailed across a shallow stretch of water I realised that something queer had happened to the middle section of the vessel. A moment later the "*Titanic*" fell to pieces, and I found myself in the water surrounded by floating petrol tins. Quickly I scrambled ashore and revenged myself on my friend, who had become almost helpless with laughter at my predicament.

E. C. STONYER (New Zealand).



On these pages we review books that are both of interest and of use to readers of the "M.M." We have made arrangements to supply copies of any of these books where readers find difficulty in obtaining them through the usual channels.

Orders should be addressed to the Book Dept., Meccano Limited, Old Swan, Liverpool, and 1/- should be added to the published price of the book to cover the cost of postage. The balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

"The Harvest of the Woods"

By EDWARD STEP
(Jarrolds Publishers Ltd. 5/- net)

This book, which is a continuation of Mr. Step's two other volumes on spring and summer flowers, has been written specially to interest the Nature lover and the rambler in our native plants. Without the use of technicalities, the author gives us an account of many interesting facts of plant life. He tells us also of plant associations and of the preferences or aversions they have for particular soils. Many other things that puzzle the average rambler are dealt with—such as the lichens and other obscure plants.

The story carries us through the autumn and into the new year, and includes some account of the later wild fruits and many different groups of fungi and other lowly organisms that are little known. It is pleasing to find that, wherever possible, the customary English names of the various plants are given, even though this necessitates the author inventing a few names for those plants that have been overlooked hitherto in this respect.

The book is well illustrated with 47 photographs.

"Storm-Sent"

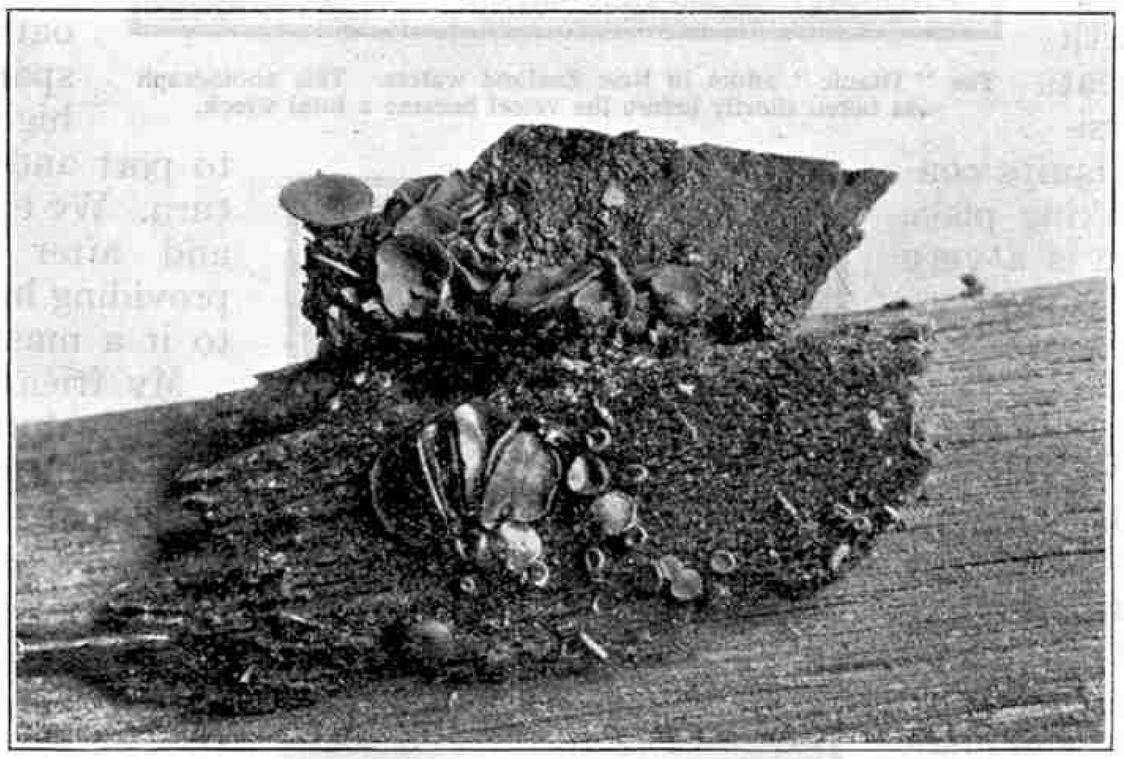
By DAVID KER
(R.T.S. 2/6 net)

This is a pleasant story well told by a practised hand. It begins with the rescue on the coast of Panama of a boy who has been lashed to a spar and thrown overboard from a sinking vessel. The boy turns out to be dumb, but his quick wit and ability to convey his thoughts by means of rapidly drawn sketches make him a general favourite. His rescuer, Sir Robert Appleby, christens him "Storm-Sent" and adopts him.

A lucky accident places Sir Robert in possession of the secret of the whereabouts of sunken treasure. "Storm-Sent" detects the nefarious designs of a traitorous member of the expedition that goes in search of it and helps to foil the piratical gang with which the man is associated. With the aid of two friendly Americans Sir Robert brings the treasure to the surface and uses it to save his family estates from being sold.

The story ends happily, for a dangerous operation restores the power of speech to "Storm-Sent," who eventually becomes a very famous artist.

Madagascar cats or lemurs near Umdoni Park. (From "Glimpses of South Africa," reviewed on the opposite page.)



Violet Saucer (*Humuria violacea*) one of the illustrations from "The Harvest of the Woods," reviewed on this page.

"The History of the Great Western Railway"

By E. T. MACDERMOT
(Great Western Railway Company. 21/-net)

We have recently had an opportunity of reading these two volumes—instalments of the history of the Great Western Railway to be completed by two further volumes at some future date. The period covered by these two volumes dates from 1833-63, and the history has been compiled with great thoroughness from the original records of the company.

From a perusal of these pages we are able to gain some idea of the great ingenuity and patience, the many experiments, and the amount of scientific inventiveness that have gone to the slow building up of this great railway. It is interesting to learn that the railway originated in 1832 as the result of the enterprise of a committee of Bristol merchants. They appointed Brunel as their engineer to survey the route, and after the meeting of a financial committee in London the prospectus was issued in the following year. The title Great Western Railway was agreed upon in place of "Bristol and London Railway," which had been the original name of the enterprise. A Bill for the promotion of the railway came before Parliament in 1834, and although it was passed by the Commons it was rejected by the Lords, only to be passed by both Houses the following year. Work commenced on the undertaking and the line between London and Maidenhead was opened on the 4th July, 1838.

As our readers will remember, originally the gauge of the Great Western was 7 ft., this being adopted on the advice of Brunel. As the narrow gauge was being laid down throughout the rest of England much controversy ensued as to the merits of the respective systems. After the famous "Battle of the Gauges," the Great Western decided to convert their system to the narrow gauge, it being evident that the narrow gauge would eventually become general.

Three interesting chapters are devoted to

early signalling and methods of working, and there is a lengthy section on locomotives and rolling stock, written by the late E. L. Ahrons. Most of the two volumes are, however, occupied by an account of the bitter Parliamentary fights that took place between the Great Western Railway and neighbouring lines, and an account of the various small lines that now form part of the Company.

The books are made more interesting by the numerous illustrations and early photographs of locomotives, stations, signals, portraits of railway pioneers, and maps showing the system at different periods.

"Glimpses of South Africa"

By Noel Wright
(A. & C. Black Ltd. 10/6)

In recent years South Africa has aroused considerable interest in the average Briton, not only because it is a delightful holiday ground, but also because it is a possible home for those who wish to emigrate. After a preliminary survey of the Union the author takes us on a leisurely journey of exploration and of observation. First, we are taken to the Cape Peninsula and then by the coast route to Port Elizabeth, East London, and Durban. The journey is then back over the overland route to Cape Town, and north to Bulawayo and the Victoria Falls, the return being through Johannesburg and Pretoria.

We learn that much interest is taken in South Africa in such games as tennis, bowls and cricket. Rugby is rapidly taking firm hold in the country, its strenuous form appealing to the young and hardy South Africans. The number of fine players is rapidly increasing, and when the next team of "Springboks" comes to the British Isles we are promised some rare matches. Tennis may be termed a national game, as it is played in cities and towns by young and middle-aged alike. The favourable climate makes it possible to play practically all the year round, and hard courts are the general rule. We learn that "whether they be footballers, cricketers, or tennis players, most South Africans, on coming to the seaside drop their particular recreation in favour of surfing, the most delightful of pastimes. It is in many respects similar to tobogganing, and the thrill to be derived from riding seawards on the foaming crest of a large breaker must be experienced before the full joy of it can be realised."

This book will be read with pleasure by those who are interested in travel, but will be more particularly useful to any of our readers who are contemplating making their home in some portion of South Africa.

The first gorge below the Victoria Falls, showing the famous Zambesi Bridge in the background (see below).

"The Third Robin Featherstone"

By C. C. Douthwaite
(W. R. Chambers Ltd. 3/6 net)

Robin Featherstone is a boy from the prairie provinces of Canada, who against his will has been sent to an English public school. There he meets with the difficulties usual to those who are transferred from one kind of life to another that is its exact opposite, but after the usual fights with bullies and strenuous exertions in games and school he succeeds in making himself thoroughly at home and his colonial views on the value of education in the Old Country are broadened.

As a story of school life the book is decidedly good. The yarn is made more interesting by the efforts of unknown unsuspected enemies among his schoolfellows to bring about Robin's disgrace and expulsion. The explanation comes in the final chapters, when Robin is surprised to find that his father has arrived in England, and that he himself is the third of a well-known county family and prospective possessor of a title and a large country estate. The book is pleasantly written, and the plots and counterplots are successfully woven together so that the reader will follow events with breathless interest to the very end.

Nos. 5-8 in "The Nautilus Library"

(Philip Allan. 3/6 net each)

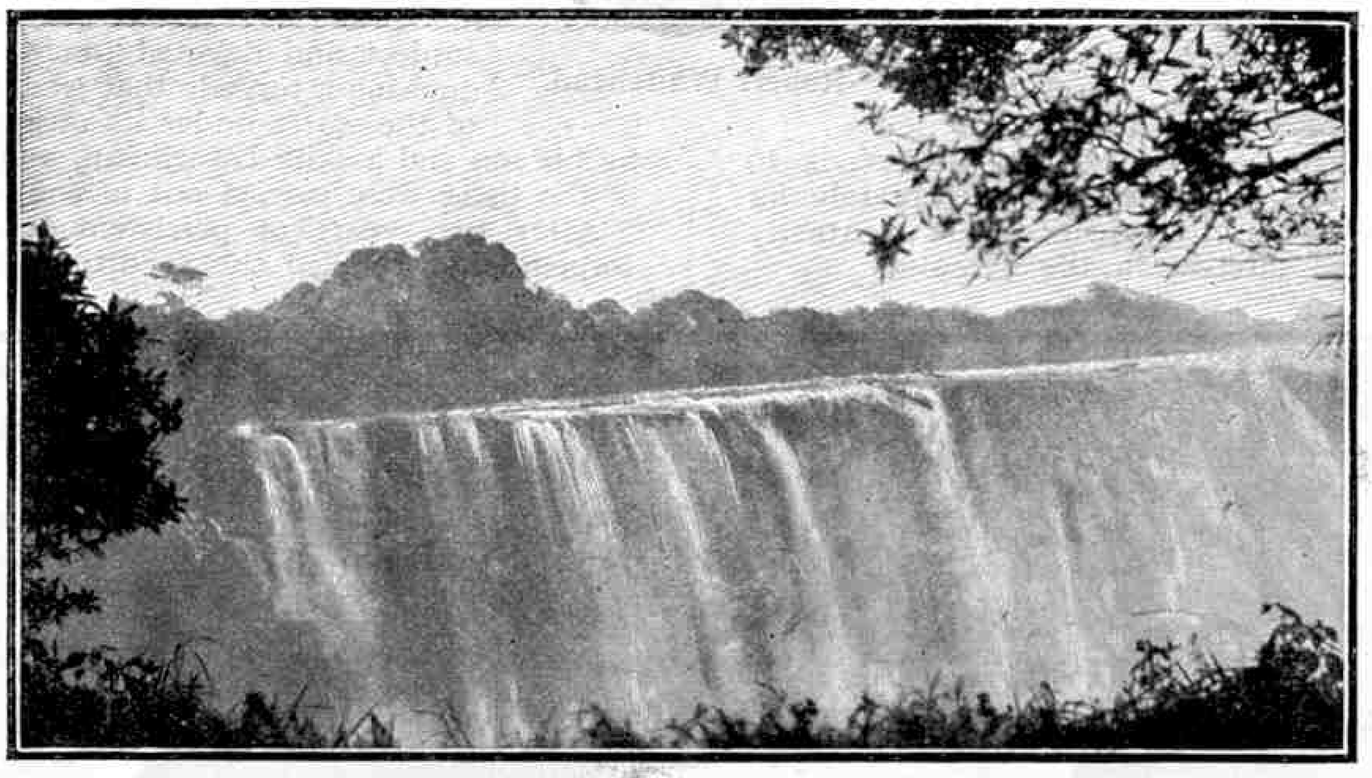
These four volumes are a welcome addition to a splendid little series, the aim of which is to present some of the best stories of the sea in a handy form and at popular prices.

In "*Sea Adventures of Britain*" (No. 5) "Taffrail" relates the thrilling voyages of Hawkins, Frobisher, Drake, Dampier, Anson, and Captain Cook. His last two stories tell of the exploits of Sir John Franklin and Captain Scott, two great explorers in the polar regions.

"*The Cruise of the Alerte*" (No. 6) by E. F. Knight, is a true story of an expedition to hunt for hidden treasure in the island of Trinidad. As a story of adventure it will thrill those readers who remember R. L. Stevenson's famous classic. Although no treasure actually is discovered, there is much to interest those who enjoy this type of story.

"*The Story of H.M.S. Victory*" (No. 7) by G. Callender, gives us an account of Nelson's flagship—the vessel on which he triumphed at Trafalgar. The book comes at an opportune moment, for the famous old warship is now open to the public at Portsmouth, after having been reconstructed and reconditioned. The story tells of the building of the famous ship; fitting out and manning her; campaigning and battle; and finally of Trafalgar, the climax of her adventurous career.

"*Strange Adventures of the Sea*" (No. 8), by J. G. Lockhart, is a book of murders, maroonings, treasure hunts, piracies, mutinies and tales of horror on the high seas! There are enough murders, robberies and fights in this book to satisfy the most bloodthirsty, and each is so well told that it is impossible to prefer one to another. It is enough for us to say that those readers who revel in this type of wholesome adventure will scarcely be able to lay down the book until the last page has been read!



Part of the main Victoria Falls as seen from the Rain Forests. (From "Glimpses of South Africa," reviewed on this page).

New Books

We hope to deal with the undermentioned books in an early issue.

"A.B.C. of Television"
by R. F. Yates. (Chapman & Hall Ltd. 10/6)

"Strange Tales of the Seven Seas"
by J. G. Lockhart.
(Philip Allan & Co. Ltd. 8/6)

"The Book of the Aeroplane"
by J. L. Pritchard.
(Longmans Green & Co. Ltd. 7/6)

"The Wonder Book of Soldiers"
by Harry Golding, F.R.G.S.
(Ward Lock & Co. Ltd. 6/–)

"Too Big for the Fifth"
by R. A. H. Goodyear (Ward Lock & Co. Ltd. 5/–)

XIV.—THE STORY OF THE WHITEHEAD TORPEDO

THE first suggestion for the construction of anything of the nature of a torpedo came in 1775 from David Bushnell, an American submarine inventor. Bushnell was interested in the problem of exploding gunpowder under water and had come to the conclusion that a submersible boat offered the best means of doing this. His idea was that an enemy ship might be destroyed by thrusting against it a closed vessel containing a charge of explosive that would detonate immediately on striking the hull.

Bushnell's invention was described in the article on the submarine that appeared on page 576 of the "*M.M.*" for July, 1928. The magazine of explosive was attached to his submersible boat by a cord and a clockwork mechanism was provided by means of which the powder could be exploded at a pre-arranged time. A trial was given to the boat during the American War of Independence, an attempt being made to blow up the "*Eagle*," one of several British warships then in New York harbour. The attempt was made at night, but was not successful, and when daylight came the man in charge of the boat discarded the magazine. This was carried away by the tide and exploded an hour later at a considerable distance from the warship.

Another inventor of submarines, the American engineer, Robert Fulton, equipped at least one of his vessels with a magazine similar to that devised by Bushnell. During 1801 Fulton offered his vessel to France, then at war with Great Britain. In a demonstration at Brest he was successful in blowing up a pontoon by means of his invention, and he then undertook to sink a British warship in a similar manner. Unfortunately for the inventor no vessel appeared in the vicinity and eventually the French authorities lost all interest in the invention.

Robert Whitehead.

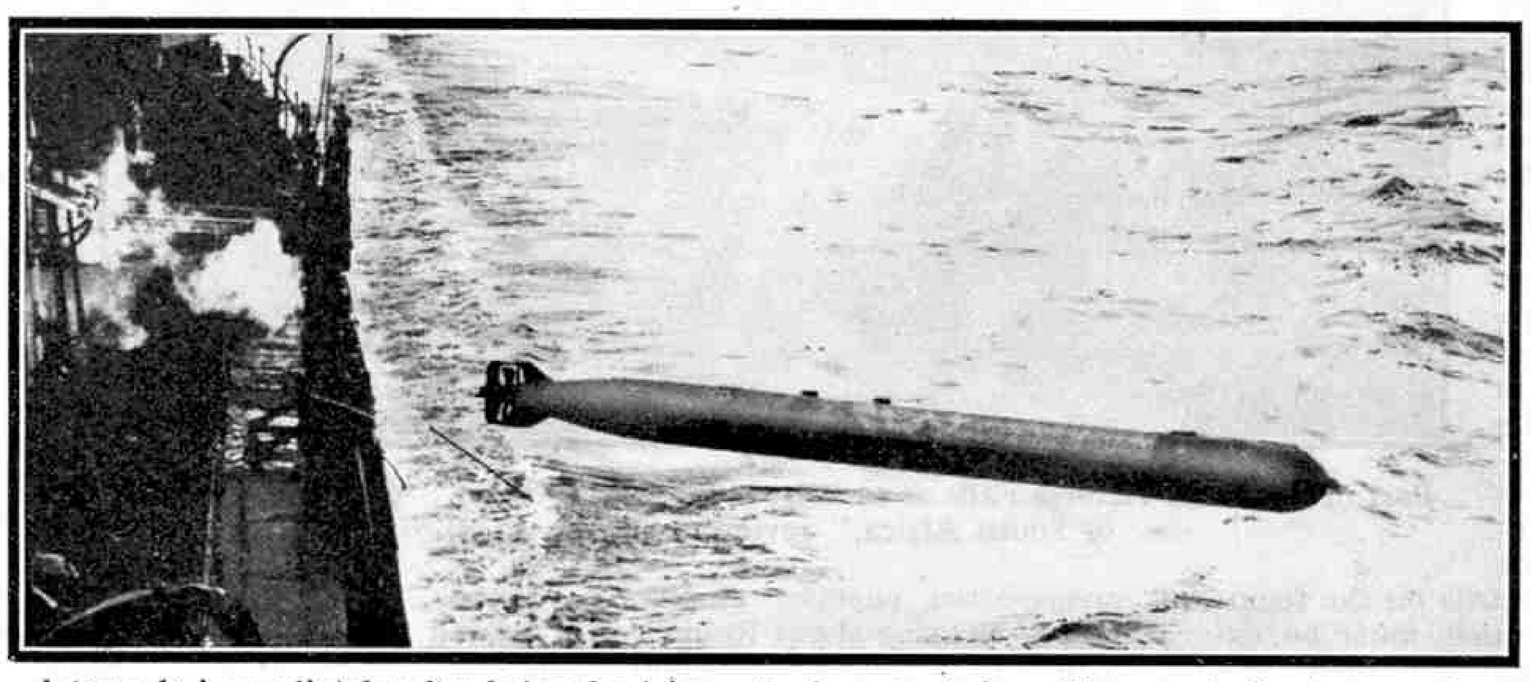
The next stage in the development of the torpedo came 60 years later, when many types were suggested by inventors for use during the American Civil War. The most successful of these took the form of a small container loaded with explosive that was attached to a long pole or spar projecting from the bow of a boat. This armed craft was steered toward the object of attack and the container, or "spar torpedo" as it was called, was brought into contact with the hull before the charge was exploded by means of an electric battery. No fewer than 34 vessels were blown up in this manner during the war, but the risks were so great that often the attackers perished along with their victims.

At the close of the struggle in America interest in torpedoes died away and was not revived until the invention of the Whitehead torpedo. Whitehead was the manager of an engineering company at Fiume, then an Austrian seaport, and he became interested in the subject as the result of an application for assistance made to him by an Austrian officer named Captain Luppis, who had carried out preliminary experiments in order to find means of propelling a small floating vessel charged with explosive. The intention of the inventor was that his vessel should be driven by a clockwork mechanism and the charge exploded by an ordinary gunlock action. In order to avoid risk to the attackers using his torpedo, Luppis tried to steer his invention from a fixed base ashore by means of guide ropes.

The Austrian Naval Authorities examined Luppis' invention and after trials informed him that better means of propulsion and more reliable steering were necessary. It was in order to improve his torpedo in these directions that he called in the aid of Whitehead. The Englishman was not greatly impressed by the torpedo planned by the Austrian officer, but he was quick to realise the value of the idea. He abandoned as impracticable the method of operation adopted by Luppis and soon afterwards this officer seems to have lost interest, for no further mention of him in this connection appears.

Whitehead became thoroughly engrossed in the subject and devoted practically all his leisure time to devising a torpedo that would travel beneath the surface of the water under its own power. He was aided only by his son and a skilled workman, and the numerous experiments of the three were carried out in complete secrecy.

After two years of persistent work Whitehead produced a torpedo that fulfilled the conditions laid down by the Austrian Naval Authorities. It was built of steel, was 1 ft. 2 in. in diameter and weighed 299 lb. Motive power was supplied by compressed air stored under a pressure of 350 lb. per sq. in. in a special chamber strongly built of boiler plate. Under favourable sea conditions the torpedo could travel a distance of 700 yards at a maximum speed of 7 knots. Unfortunately it failed to maintain a uniform depth, at one moment rising near the surface of the water and at the next plunging downward. Whitehead had incorporated a device to keep it submerged at a constant depth, but this proved to be uncertain and inefficient in action.

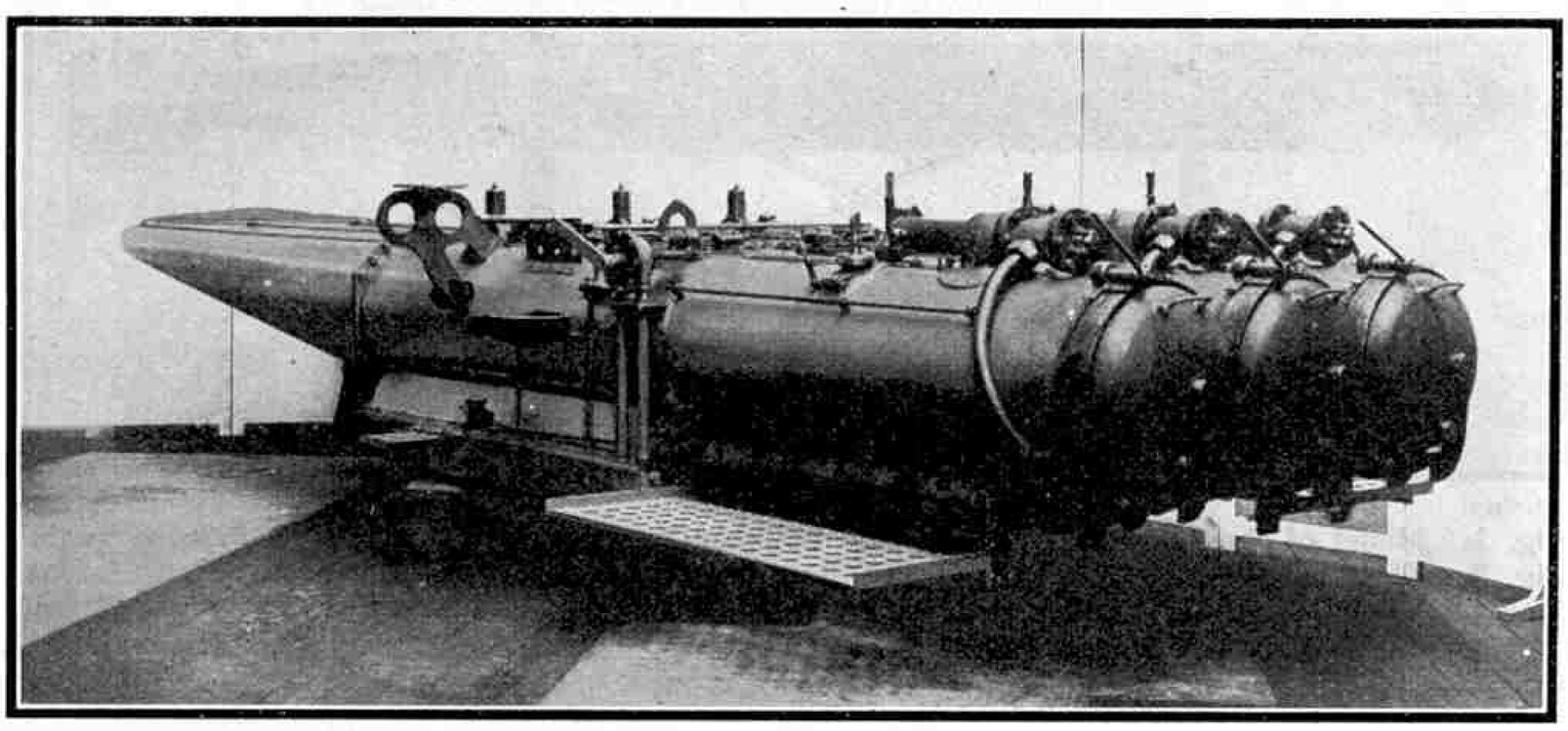


A torpedo immediately after being fired from the impulse tube. For permission to reproduce this and the illustrations on the opposite page we are indebted to the courtesy of the Whitehead Torpedo Company Ltd.

In spite of this defect Whitehead's invention was a remarkable

improvement upon the crude torpedo devised by Luppis, and it received a more favourable reception from the Austrian Naval Authorities. At their request a submerged tube was installed on a gunboat and during 1867 and 1868 trials were carried out under the direction of a committee of naval officers and engineers. At the conclusion of the tests the committee recommended the adoption in the Austrian Navy of the torpedo, but financial reasons prevented the Government from acting upon this advice.

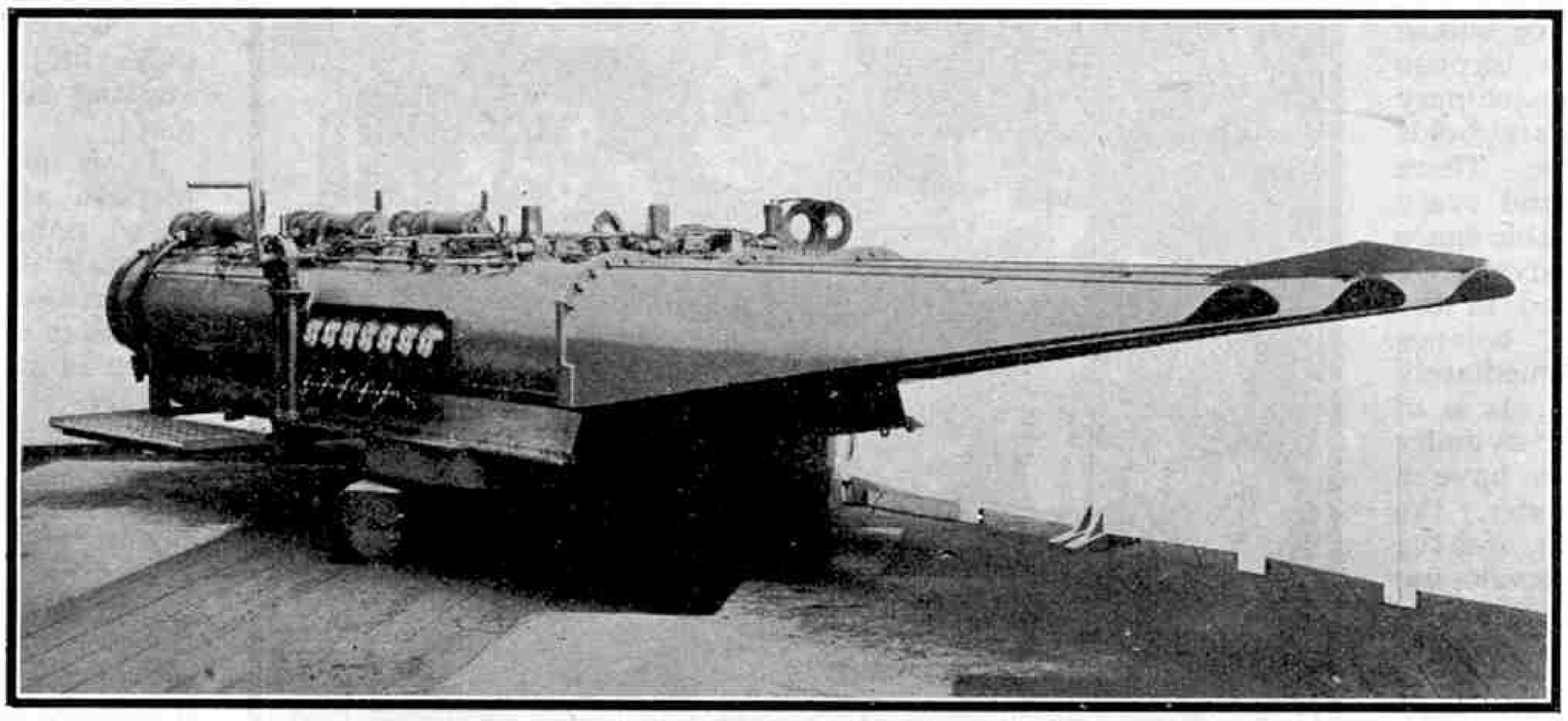
The most unsatisfactory feature of Whitehead's first torpedo was the depth control gear, and during 1868 the inventor improved this greatly. His earliest mechanism of this kind consisted of a hydrostatic valve, in which the pressure of the water acted on a piston that, in turn, controlled the movements of the diving rudders. To this he now added a pendulum that was connected to a second pair of rudders in such a manner that its swing moved the rudders in the direction necessary to check the unwanted movement whenever the torpedo shot upward or dived. The new mechanism greatly improved the performance of the torpedo.



Rear view of a triple Torpedo Tube showing the doors that are lowered in order that the torpedoes may be inserted in readiness for discharge.

The Austrian Government were unable to purchase Whitehead's invention and in consequence he tried to sell it to some other Power. Information regarding Whitehead's work had reached the British Admiralty and on learning of his readiness to enter into negotiations they instructed the Commander-in-Chief of the Mediterranean Fleet to examine and report upon his torpedo.

The report proved to be so favourable that the Admiralty requested Whitehead to visit England in order to give a demonstration. The inventor accepted the invitation and brought with him two torpedoes and a tube from which they could be discharged from an under-water position. The torpedoes were similar in construction, each being driven by means of a single screw propeller operated by a compressed air engine, but one was charged with 18 lb. of dynamite and the other with 67lb. of gun cotton. The length of the first of the torpedoes was 13 ft. 10½ in., and its diameter 1 ft. 2 in., while the second was 1½ in. longer and 2 in. wider.



Another view of the triple Torpedo Tube shown in the upper illustration. The overhanging hoods are to prevent the torpedoes from canting upward as they are fired.

The trials were carried out at Sheerness in July, 1870, and were witnessed by a naval committee appointed by the British Admiralty. An old battle sloop named "*Oberon*" was used for the purpose, the submerged tube brought by Whitehead being fitted in the bow of the vessel. Each torpedo was discharged from this tube by a thrust from an impulse rod actuated by compressed air.

Apparently the torpedoes were not immediately expended against a target, for more than 100 runs were successfully carried out with them during the trials. It is recorded that the torpedoes attained an average speed of 7.5 knots over a distance of 600 yds., and an average speed of one knot greater over the shorter distance of two hundred yards.

No doubt the trials were concluded by a demonstration of the destructive powers of the torpedoes, but nothing is known on this point. The demonstrations won the approval of the committee, and their report to the Government was so favourable that during 1871 Whitehead's invention was purchased for £15,000.

Although the torpedo was already a deadly weapon there was still room for improvement both in its construction and operation, and Whitehead continued his experiments. During 1876 he succeeded in producing a much speedier torpedo, his new model being capable of a speed of 18 knots over a distance of 600 yds. An even greater improvement was the introduction of more efficient depth control gear. The hydrostatic piston and the pendulum used in earlier torpedoes now were connected together, both acting through a servo-motor on the same diving rudders. This was the final step in the solution of the problem of maintaining a uniform depth and converted the torpedo into a reliable instrument.

By this time many countries had purchased the right to make Whitehead torpedoes. In 1872 France followed the example set by Great Britain, and in the following year Germany and Italy also acquired the invention. Other nations acquired the torpedo, and within a few years it became part of the regular equipment of practically every naval force of any importance in the world.

The modern torpedo is a veritable triumph of invention, for it is full of costly and delicate mechanisms that make it quite automatic in action. It is essential that this should be the case, for a torpedo is blown violently out of a tube and during its brief career in the water it must keep exactly to the course intended or be wasted.

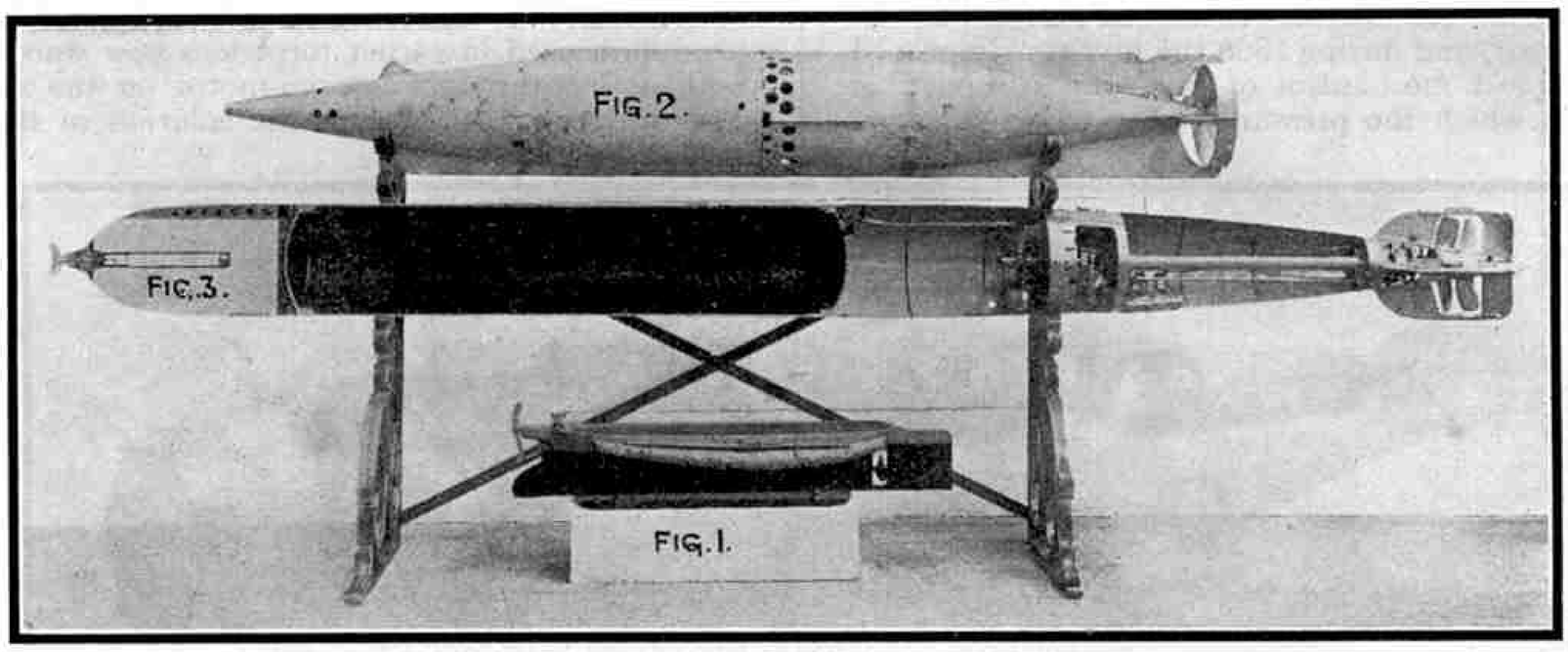
The type of Whitehead torpedo made to-day is 23 ft. in length, 1 ft. 9 in. in diameter and carries an explosive charge weighing 660 lb. The total weight of such a torpedo when loaded is 3,300 lb. It costs from £1,500 to £2,500 or more to construct, but it is capable of crippling or even sinking a battleship worth millions of pounds, and carrying a crew of more than 1,000 men. Thus, its high cost is insignificant in comparison with the immense damage that it can do.

The charge of explosive that makes the torpedo such a deadly missile is carried in the "warhead." This is at the front of the cigar-shaped metal tube that forms the casing of the torpedo and is made of thin steel. It is almost filled with trinitrotoluene, the formidable explosive more familiarly known as "T.N.T.," and the deadly charge is fired on impact with the inertia pistol. This has been compared to a cup and saucer, for it consists essentially of a heavy cup that is kept on its seat by a spring. When the head of the torpedo touches anything the cup heels over and releases a trigger that fires a detonator. This is embedded in a small quantity of fulminate of mercury, usually described as the "primer." This explodes and the violent shock administered to the main charge of T.N.T. causes it also to explode with terrific violence.

In torpedoes intended only for practice no explosion is allowable,

for this would involve the needless loss of a very costly product. Instead the warhead is replaced by one of similar size and shape that is filled with water and ballasted in order to give it the same total weight. At the end of a practice run the water in the head automatically is blown out by compressed air. This gives the torpedo sufficient buoyancy to enable it to float and it does so with the head thrown almost vertically upward, thus making its recovery an easy matter.

Immediately behind the head comes the "air vessel," as the second compartment is called. This is a very important section of the torpedo, for it carries the compressed air required by the engine and consequently must be absolutely air-tight. In form it is a tube of high tensile steel, machined inside and outside to exact dimensions, and its ends are closed by hemispherical covers secured in place by a special form of screw thread. Into this air vessel no less than 250 lb. of compressed air is forced.



Courtesy] [*Whitehead Torpedo Co. Ltd.*

Fig. 1. Model of the explosive-carrying boat designed by Capt. Luppis for coast defence work. Fig. 2. The first Whitehead Torpedo. Fig. 3. A sectional model of a modern torpedo. The long dark compartment is the air chamber and ahead of it is the space in which explosive is stored.

An interesting feature of the modern torpedo is that on its way to the engine the compressed air is heated by a petroleum burner in order to increase the available energy. The use of this burner involves a rise in temperature and water is injected into the heater to prevent this from reaching excessive proportions. This water is carried in a chamber formed by an extension of the shell of the air vessel, which also is closed by a hemispherical cover.

The rest of the space within the outer casing of a torpedo contains the delicate machinery that drives it forward and holds it to its intended course. There is no room to spare and every cubic inch of the available space is used to the best advantage.

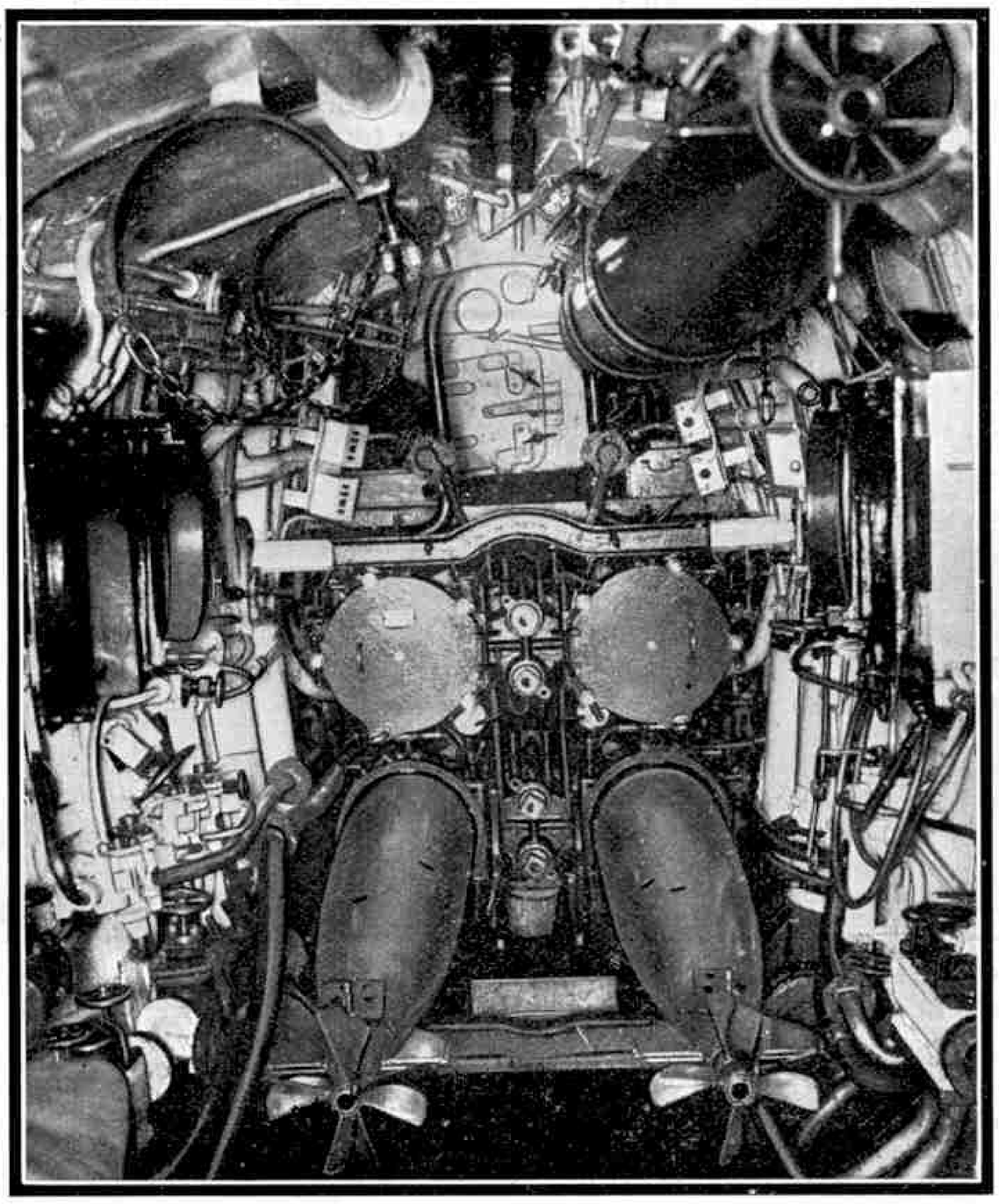
The engine is placed in the after portion of the "balance chamber," which is immediately behind the air vessel. It is of the double-acting two-cylinder type. The cylinders have a bore of 5 in. diameter, the stroke is 6 in. in length, and the engine is capable of developing as much as 400 b.h.p.

When the torpedo is fired the engine is automatically set in motion by a lever that is thrown over by a projection in the impulse tube. Compressed air then passes through a pressure-reducing valve to a combustion chamber. Petroleum also is sprayed into this chamber, where it is ignited by a pair of slow-burning cartridges, the amount of the fuel introduced being proportioned to the quantity of oxygen in the compressed air available for its combustion. Water also is injected into the combustion chamber in order to prevent the temperature from becoming too high, and the whole mixture of compressed air, burning petroleum and steam enters the cylinders of the engine at a temperature of about 650°C.

Lubrication of the engine is very important, and for this purpose oil is fed to all bearings by a rotating distributor that is turned through reduction gearing from the engine shaft. The running parts of the engine are kept cool by the injection of sea water into the exhaust.

The crankcase of the engine projects into what is called the "afterbody," which lies between the balance chamber and the tail. Through the afterbody pass two concentric shafts driven by the engine, each of which carries a screw propeller. One of the propellers is right-handed and the other left-handed. Both revolve in the open frame of the tail of the torpedo, and the two are used in order to eliminate the heel that would result from the employment of a single propeller.

Much of the efficiency of a torpedo depends upon its ability to travel quickly through the water. For a run of 3,000 yards the speed usually is fixed at between 44 and 46 knots, and the time taken to cover this distance is about 120 seconds. If any time were wasted in starting the run, or in working up speed, an opportunity would be given to the officer in charge of the target to avoid the impact, and thus the engine must be of such a character that it springs into action at practically full speed the instant the torpedo is launched.



The fore-part of a Submarine showing the bow torpedo tubes.

An engine of the type described fulfils this condition. The remarkable nature of its performance may be realised by comparison with that of a motor car engine on a cold morning. If this acted as rapidly and efficiently as that of a torpedo, the car would have no difficulty in travelling one-and-a-half miles in two minutes when starting absolutely cold from rest!

It is not enough that the torpedo should reach a high speed immediately and should maintain it throughout its run; it must also keep a perfect depth line, that is, it should stay at a depth of about 13 ft. below the surface. It can be set to run at this or any desired depth by means of the special control gear consisting of a hydrostatic piston and pendulum already described. This acts on the slide valve of a servo-motor in the engine room and thus its movements are conveyed through a steering rod to the horizontal or diving rudders on the tail of the torpedo. The control gear of a torpedo that is to travel at more than 50 m.p.h. must be very carefully adjusted, otherwise the missile will alternatively dive and rise.

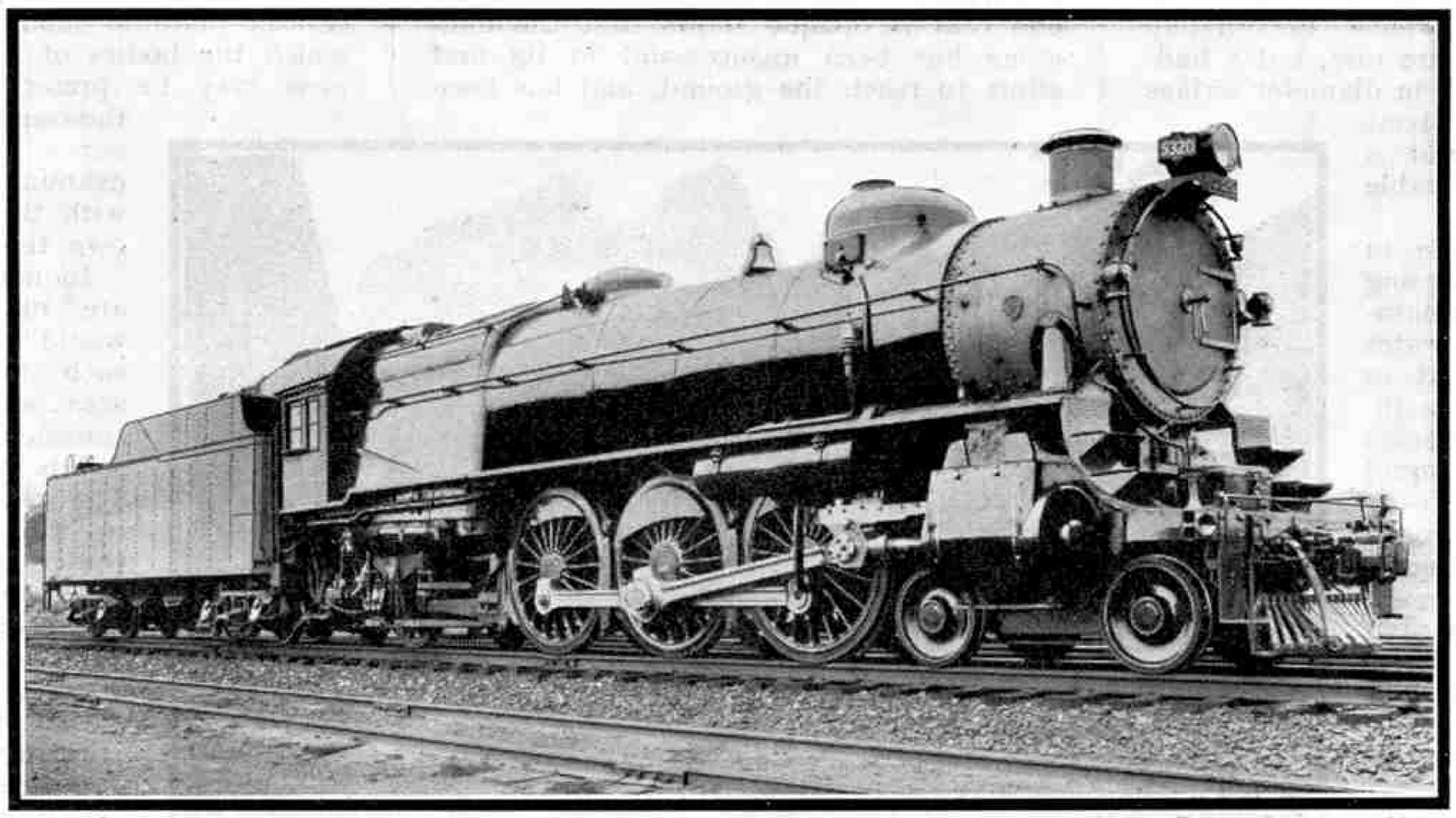
The most difficult of the tasks that confront the designer of a torpedo is to ensure that it will keep a straight course. Its initial direction is determined by the position of the tube from which it is fired, and after it has started out on its journey further control over its movements is impossible. It is absolutely essential to incorporate a mechanism that will hold it to its intended course. Without this it would be quite impossible to guarantee hitting a fixed target, and the chances of hitting one that is moving would (*Continued on page 140*)

British Influence on U.S. Engine Design

The "*President Cleveland*," B. & O. Railroad

By H. H. Humphries

SOME time ago we promised to publish further details of the Baltimore and Ohio Railway locomotive "*President Cleveland*," the design of which was strongly influenced by the Great Western Railway locomotive "*King George V*." During the celebration of the centenary of the Baltimore and Ohio Railroad—the first railway operated in the United States for the public handling of passengers and freight—"*King George V*" was sent over as an ambassador of British engineering, and this fine locomotive aroused great admiration on all hands. Its influence upon the design of the "*President Cleveland*" is clearly seen from the accompanying photograph.



Courtesy] [*Baltimore & Ohio Railway*

The "*President Cleveland*," Baltimore and Ohio Railway, the design of which shows the influence of the G.W.R. locomotive "*King George V*."

In designing the "*President Cleveland*" an effort was made to eliminate as far as possible all the unsightly pipes and other mechanical items that are usually found on the exterior of an American locomotive. It was also sought to re-distribute several accessories in positions where they would not destroy the smooth streamline effect of the locomotive.

A few examples will make this clear. The air compressor, instead of being situated on the left-hand side of the boiler as is usual, is placed between the frames behind the main driving wheels. The headlight generator, which on most locomotives is on the top of the boiler, is placed on the rear deck, on the left side, and is conveniently situated for adjustment from ground level. Nearly all the air piping is suspended beneath and close to the running board where it is not visible except on close inspection. Wherever possible the air pipes and also a number of other pipes have been electrically welded in order to eliminate screwed joints.

The locomotive is equipped with an exhaust steam injector for forcing the feed water to the boiler, instead of the usual high pressure injector used on the majority of locomotives in the United States. The use of this injector provides economy in fuel because excess steam is used which ordinarily goes to waste. The front end of the locomotive is designed to allow for easy access to the interior of the smokebox, and for inspection and repair purposes it is only necessary to loosen one bolt.

One of the principal variations from the usual type of locomotive is found in the firebox, the inside dimensions of which are 10 ft. by 7 ft. Ever since the introduction of steam locomotives the practice has been a construction consisting of an inner and an outer shell with water space between the sheets, which are stayed or secured from bulging from boiler pressure by means of staybolts. The firebox on the "*President Cleveland*" is so constructed that it has not a single staybolt.

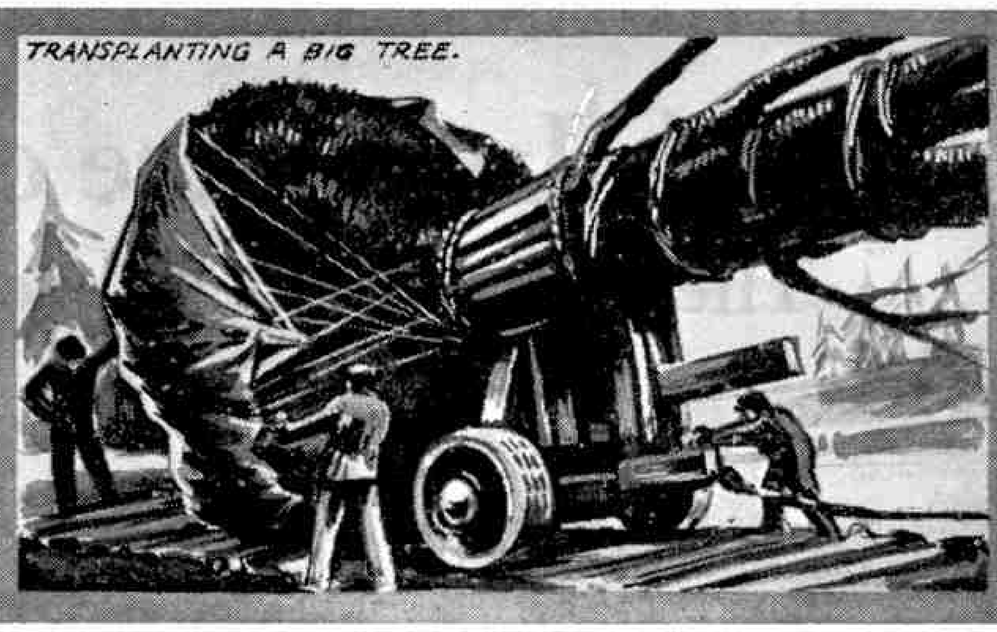
The front part of the boiler follows general practice and consists of several cylindrical courses containing fire or gas flues. The rear or firebox portion consists of two cylindrical drums at the top joined to the rear tube sheet and supported at the back end by a vertical $\frac{3}{4}$" plate in which is the fire door opening. On each side of these two top steam drums are side headers connected to them, and at the bottom of the firebox are side headers connected to a hollow casting barrel, allowing circulating of the water from the boiler to the bottom headers.

The bottom and top side headers are connected with water tubes, the exterior surfaces of which are exposed to the flames and gases of combustion. With this type of firebox there is a considerably increased heating surface.

Another departure from the usual practice is the use of Caprotti poppet valve gear for steam distribution, instead of the inside admission piston valve. There are two inlet and two exhaust valves on each side, operated by cams in a gear box placed above the cylinders. The mechanism in this gear box is driven through two transverse shafts in the body of the cylinder, and these in turn are driven by a longitudinal shaft receiving its motion from spur-bevel gear secured to the main driving axle. These gears are connected and timed with the cams, to provide the proper sequence of movements for the inlet and exhaust valves to admit steam against the piston at the beginning of the stroke, and to exhaust it from the cylinder at the completion of the stroke.

This interesting locomotive has exactly the same tractive power as the twenty "President" type locomotives, Nos. 5300 to 5319, that have (*Continued on page 140*)

Our Wonderful World



The Life Story of a Hailstone

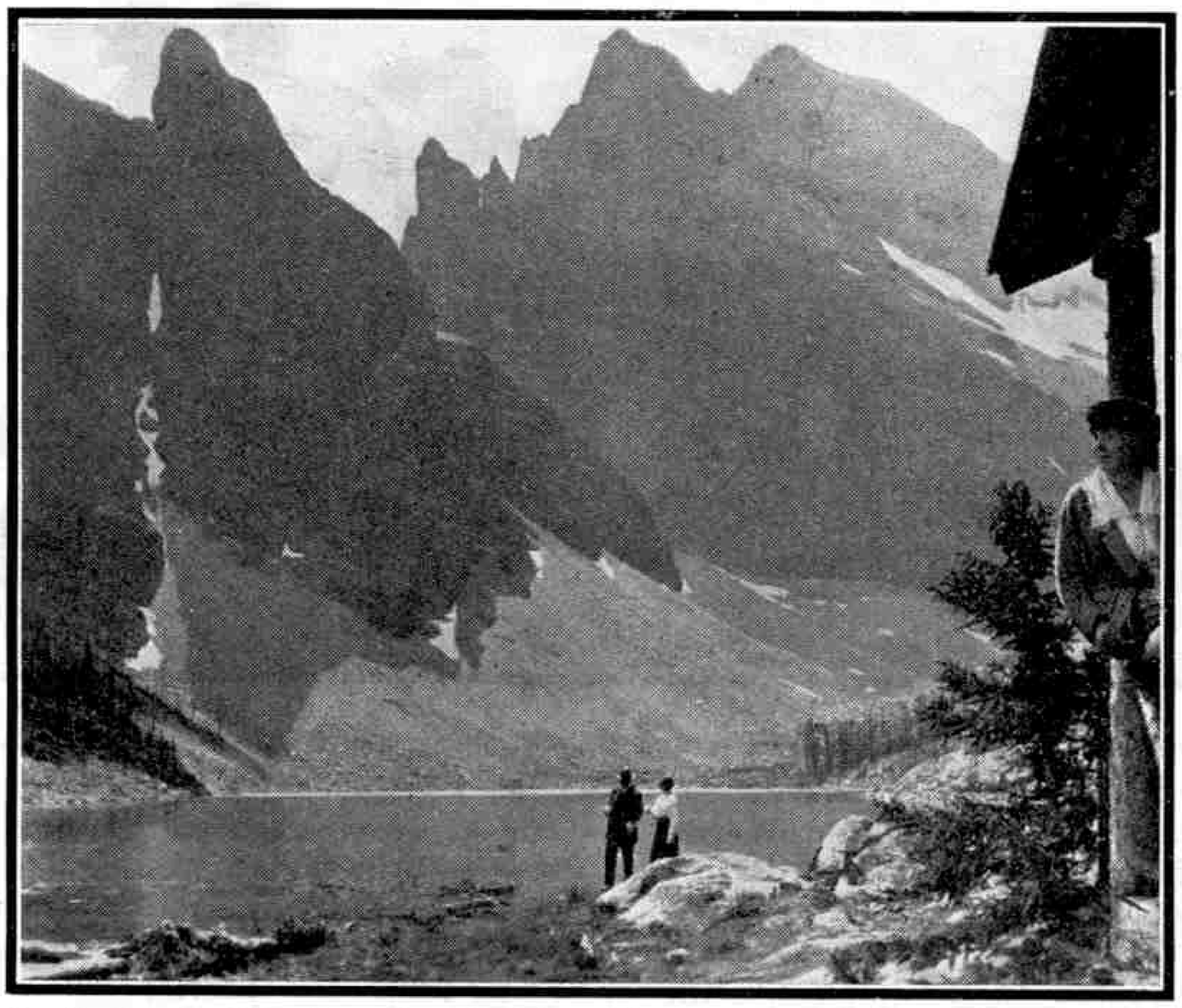
The destructive power of large hailstones is due partly to their weight, but partly also to their high speed. A spherical hailstone 4 in. in diameter hits the ground at a speed of 62 m.p.h., or at a rate of travel equal to that of a cricket ball delivered by a fast bowler. Fortunately hailstones of this size are rare, but a hailstone only half-an-inch in diameter strikes the earth at a speed of about 22 miles per hour, and is capable of doing considerable damage.

Hailstones begin life in the path of an oncoming storm in the form of a number of molecules of water vapour scattered about in damp air close to the earth. The water vapour condenses and the tiny drops of liquid are carried upward by rising air currents. As they ascend they gradually become larger. Finally they reach a height of many thousand feet above the earth. There the temperature is very low, and some of them are transformed nto small particles of ice or hailstones.

Freezing does not take place instantaneously and many of the drops remain in a super-cooled state. When collisions bring these into contact with hailstones already formed they freeze up immediately and help to form a larger piece of ice. The upward flight of one of these particles ends when it becomes too heavy to be supported by the current of air. In its descent the hailstone absorbs any unfrozen drops of water that it encounters, and simultaneously moisture from the air condenses on it in the form of minute ice crystals, with the result that by the time the hailstone has descended to warmer levels it has acquired a coating of opaque ice.

On a hailstone a covering of translucent ice usually may be seen. This has been formed slowly at atmospheric levels where the temperature is very little below freezing point. Its production may be the last stage in the history of a hailstone, for if this is now heavy enough to overcome the impulse given it by the upward current of air it falls to the ground; otherwise it is again carried upward to grow bigger by a repetition of its previous adventures. Giant hailstones probably are produced by the freezing together of smaller stones of ice, and probably this happens on the ground.

It is interesting to cut a large hailstone in half, for the successive "skins" or coatings may clearly be seen. These give a true record of the hailstone's adventurous journey through the air. The kernel is always opaque, and the presence of two coatings of translucent ice separated by one that is opaque shows that the hailstone has been unsuccessful in its first effort to reach the ground, and has been blown upward in order to grow sufficiently large and heavy to resist the influence of the ascending current of air.



In the heart of the Canadian Rockies. Our photograph shows the wonderful view that may be obtained from the Swiss Cottage, at Banff, of the mountains and lakes of Rocky Mountains National Park, one of the most famous of Canada's natural playgrounds.

The Population of an Ant Hill

Very few people have had the courage to attempt to count the number of ants that inhabit the average ant hill. Usually the hill is described as swarming with ants, and it has been assumed that only wild guesses at their number may be made. An American professor has very patiently taken a census of the ants in a selected mound, however, and has discovered that its population amounted to exactly 8,239 insects, of which 11 were queens. It is now thought that the average ant-hill contains about 10,000 inhabitants. This is much less than previous estimates.

World's Finest Museum

The construction of a museum that may become the finest in the world has been proposed by a Russian scientist. His suggestion is that somewhere in the north of Siberia, where in many places the soil is permanently frozen, a gigantic refrigerator museum should be established in which the bodies of various animals and men may be preserved, in order that thousands of years hence our descendants may examine and compare them with the creatures of their own time.

In northern Siberia there are many positions that would be quite suitable for such a museum, for over an area equal to that of the continent of Australia the soil is permanently frozen. The greater part of this is in the extreme north of the country, but what may be described as "islands" of frozen soil are found as far south as Lake Baikal, which is in the same latitude as England.

In many places the soil is permanently frozen to an astonishing depth. For instance, at Yakutsk it is in this condition to a depth of well over 100 yards, and in fact, borings at this place have not reached a layer that is not frozen! At 382 ft. below the surface the temperature was found to be 3°C. below freezing point and the rate of increase measured in a shaft sunk near Yakutsk suggests that there it would be necessary to descend to a depth of 600 ft. in order to find rock or soil that is not frozen. The exact cause of the existence of these immense areas of frozen soil is not known. It has been suggested that they are the result of present climatic conditions in Siberia, but a more interesting and quite possible explanation is that they are relics of the Great Ice Age. Thousands of years ago huge glaciers flowed northward to the Arctic Seas from the mountainous regions of Central Asia, and it is believed by some authorities that even the long period that has since elapsed has not been sufficient to allow complete thawing to take place. Huge masses of ice embedded in the ground in some parts of the country are believed to be "fossil ice," or remnants of the ancient glaciers.

Educated Elephants of Uganda

It is rumoured that every elephant in Uganda carries a complete map of the colony in its head, and uses its geographical knowledge in order to keep clear of the districts in which it is not allowed! The animals now appear to understand the regulations for their protection made by the Game Warden's Department, and know that if these are broken they will be driven back into their own territory.

A few of the elephants use their knowledge of the Game Warden's benevolent intentions towards them in order to obtain food and luxuries easily. They live alongside native farms, and even raid them occasionally, knowing that if caught in the act they will only be chased back to their reserve. One herd that has become notorious for exploits of this character has invented a new game in which the officers of the Department who attempt to drive them back to their official quarters are led along selected routes through mud holes and almost impassable swamps!

The intelligence possessed by the elephants of Uganda was shown by the actions of the members of a large herd that was purposely disturbed during its May meeting, an annual gathering that is held on the banks of a certain river. It was noticed that in their flight the animals never crossed a road until a group numbering several hundreds had been formed, thus showing that they had learned to associate roads with danger. It was even more remarkable to find that the retreat ceased as soon as the animals reached the territory set aside as an elephant preserve! There they gathered together and assumed a defensive attitude, obviously being prepared to fight if interfered with in their own country.

Owing to the protection now afforded them the elephants of Uganda are becoming more numerous, and it is believed that the male elephant population of the country is increasing at the rate of more than 1,000 annually. Unfortunately for the animals, the area in which they may roam does not increase, and the growth of the human population of the country may make it necessary to reduce the land apportioned to them.

Floating Aerodromes in the Atlantic

The scheme explained in the "*M.M.*" for January, 1929, for establishing a chain of floating aerodromes across the Atlantic Ocean has reached a more practical stage with the discovery of a suitable position for the first of the huge stations. This is at a point half-way between New York and Bermuda. There a plateau that is 3,000 ft. above the bed of the Atlantic Ocean has been discovered. The elevation is 4 miles square and its depth is only 12,000 ft.

The discovery of this shelf or plateau simplifies greatly the problem of establishing an air route between Europe and America. It is exactly at the point where the first of these stages should be anchored, for it is only 400 miles from New York and 375 miles from Bermuda. Its discovery will reduce the cost of the necessary cables.

"*Big Ben*" Reproduced in America

Some time ago KDKA, the well-known radio transmitting station of the Westinghouse Electric Co. at Pittsburgh, U.S.A., relayed from London the sound of "*Big Ben.*" The Assistant Chief Engineer was so delighted with the mellow note that is so familiar to wireless listeners in Great Britain that he decided to reproduce the sound in order that it might be broadcasted regularly from KDKA. As a result the exact note of the famous bell may now be heard marking the hours. The programme is not interrupted for the purpose, and the reproduction is heard as if from a distance.

The manner in which the tones of "*Big Ben*" have been imitated is of the greatest interest. No effort was made to produce a bell of similar tone. This would have been a lengthy and difficult task and instead the frequencies of the notes emitted when the bell is struck were carefully determined. Oscillating circuits were then designed, each of which had one of these frequencies, and the latter are impressed on the transmitter at the correct time. The effect is the same as if the actual bell were struck.

The City Hall at Los Angeles, a skyscraper that proves that modern buildings in concrete and steel may be graceful in style as well as useful.

Strange Use for Telegraph Poles

So universal is the spirit of progress in the Argentine Republic that even the country's national bird is stirred by it. This is the Oven Bird, which formerly was never seen north of the province Entre Rios, but is now found in more remote districts.

Strange to say, the bird has only migrated into those parts of the Republic that have the advantages of telegraph and telephone services! It does not understand the Morse Code, however, and has not yet learned how to handle an automatic telephone. The only reason that it has for insisting on having these services is that a telegraph or telephone pole is just what it requires as a support for its home. Its nest is a very substantial affair, almost 1 ft. in height, that has an appearance similar to that of an oven, and it is from this that the bird has obtained its peculiar name. It is built of mud and horse-hair and fibres are used in its construction in order to prevent cracking.

Formerly the nest of the Oven Bird was only found at a height of 15 to 20 ft. above the ground on trees or the walls of houses. Since an enterprising individual discovered that telegraph poles are equally suitable, these have come into general favour, and the birds have followed the lines of poles that have been erected in newly developed districts in the interior. The pioneer spirit of the Oven Bird is very satisfactory to the farmers of the Argentine, for it aids them by feeding voraciously upon destructive insects and their grubs.

Fish Cooled 77°F. Below Freezing Point

Fish that has been preserved by freezing becomes yellow when thawed out, and in addition it dries rapidly and loses weight. Careful microscopic examination has shown that this is due to the formation of large crystals of ice within the tissues. These burst and tear the flesh, allowing the essential juices to escape and also making the conditions favourable for the introduction of bacteria.

The difficulty has now been overcome in a very simple manner. The fish is merely frozen very quickly in order that the crystals of ice formed shall be very small. When this is done damage to the tissues is decreased, and the flesh retains its flavour when thawed.

More than three-quarters of the body of a fish is water. In freezing a ton of fish, therefore, it is necessary to turn three-quarters of a ton of water into ice, and to do this as quickly as is necessary to form very small crystals of ice is equivalent to cooling in less than an hour a mass of red hot iron weighing a ton sufficiently to enable it to be handled in comfort.

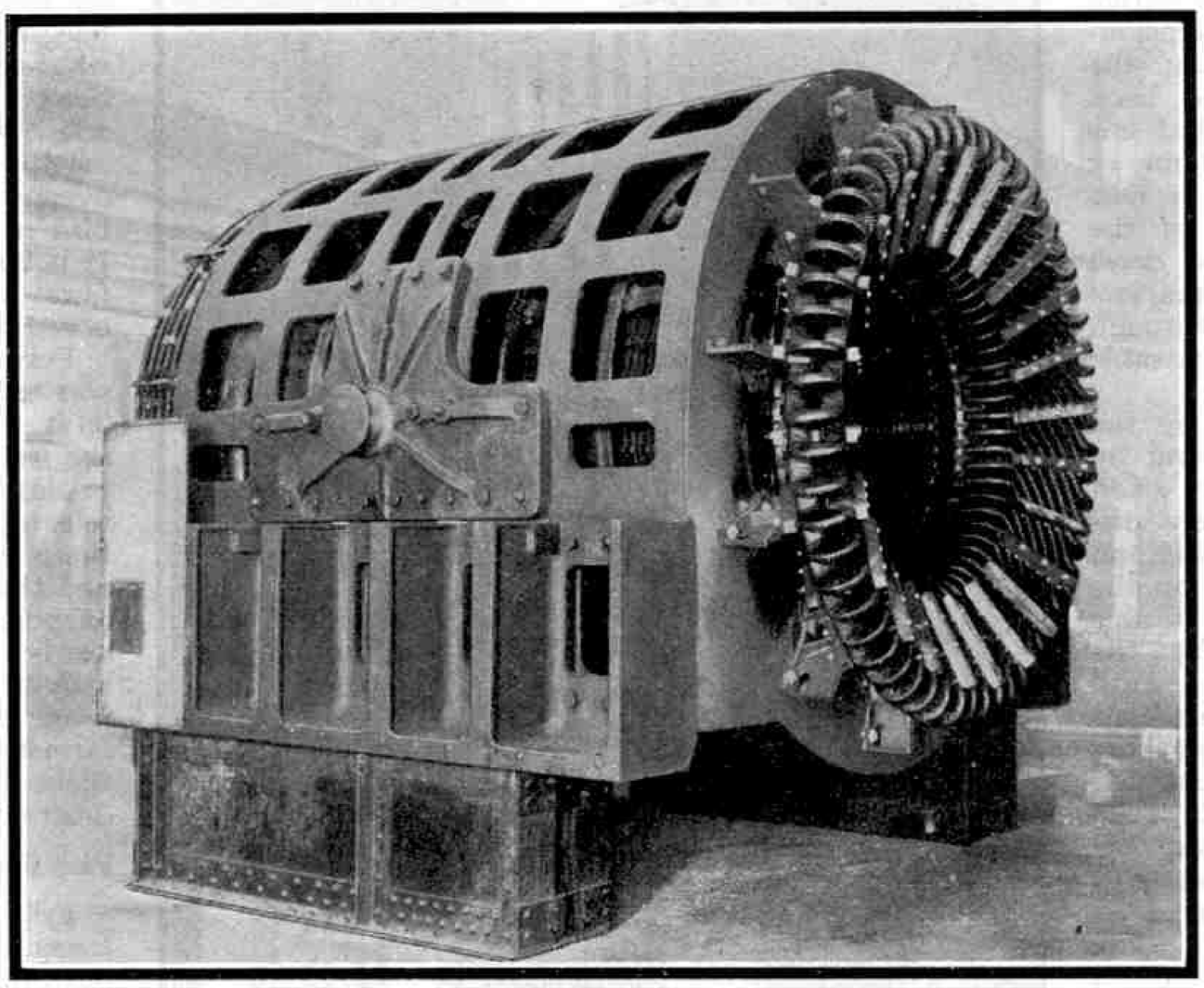
In spite of the difficulties several means of freezing fish quickly have been devised. In one the fins and bones are removed and the fish is packed ready for despatch. Before leaving the factory, however, the packages are pushed in between two wide metal belts that carry them through a frozen tunnel. The outer surfaces of the belts are sprayed with strong brine that has been cooled to a temperature of 45°F. below zero, and the fish quickly become frozen into a mass as hard as a brick.

104,000 Kw. Turbo-Generator

Interesting Unit for Chicago Power Station

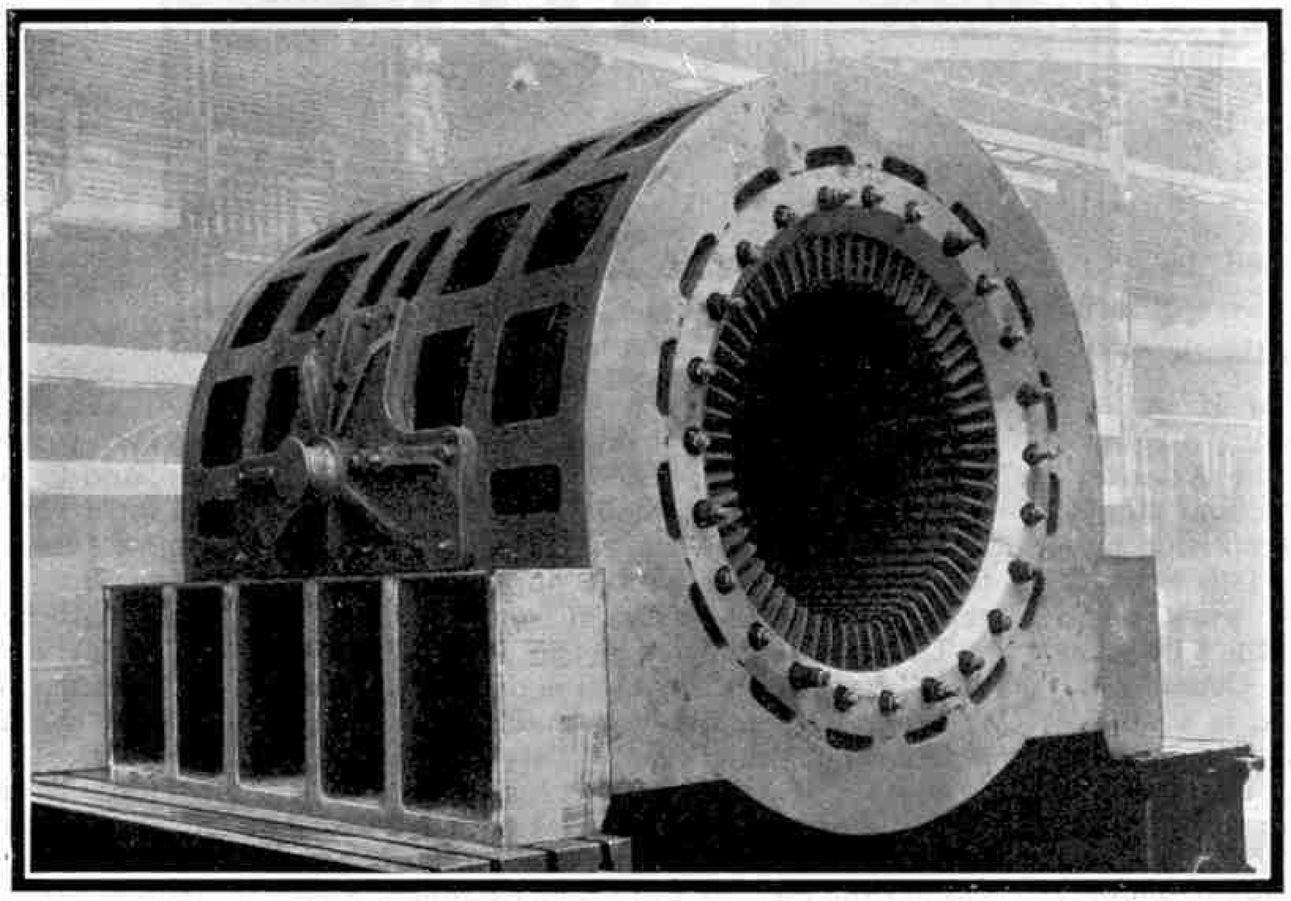
THE demand for electric current in the United States is growing so rapidly that the power supply stations are finding it necessary to increase their capacity to a very considerable extent. In consequence of this many stations have installed during the past few years generator units of enormous size and embodying every possible device for securing economy.

A noteworthy unit of this type is a 104,000 kw. turbo-generator built by the Westinghouse Electric International Co. for the Crawford Avenue Station of the Commonwealth Edison Co., at Chicago. This unit is of particular interest from the point of view of efficiency.



View of stator of main generator with windings in position. For this and the other illustrations to this article we are indebted to the Westinghouse Electric International Company.

Steam at 550 lb. gauge pressure and 725°F. is supplied to the high-pressure turbine, through which it is expanded to 61 lb. absolute pressure (at a load of 104,000 kw.). From the exhaust of this turbine the steam is conducted to a live steam reheater where the total temperature is brought to about 500°F. From here the steam is led to the intermediate low-pressure turbine, in which approximately one-third of the steam is expanded down to a vacuum of 29 in. of mercury in the thrust end, the other two-thirds being expanded down to 12½ lb. absolute pressure in the coupling end. From this point the steam is taken through a receiver pipe to a double-flow low-pressure turbine, each end of which expands one half of the remaining steam to a vacuum of 29 in. of mercury. This arrangement not only provides the required low-pressure blade area, but has many other advantages, including simplicity of design on account of the small size of each section, with accompanying low speeds and stresses.



Stator frame with lifting trunnions, frame feet, and stator laminations.

Steam is led from the main line through two strainers and through a "T" connection to the throttle valve and steam chest. The steam chest has three valves with specially shaped ports for controlling the steam flow through the turbine. The valves are controlled by a hydraulic cylinder mounted on the primary valve, and the design is such that the primary valve passes all the steam that goes to the turbine, whether through the primary nozzles or the secondary or tertiary nozzles. With this arrangement, in the event of accidental sticking of the secondary or tertiary valves, the closing of the primary valve will close off all steam to the unit.

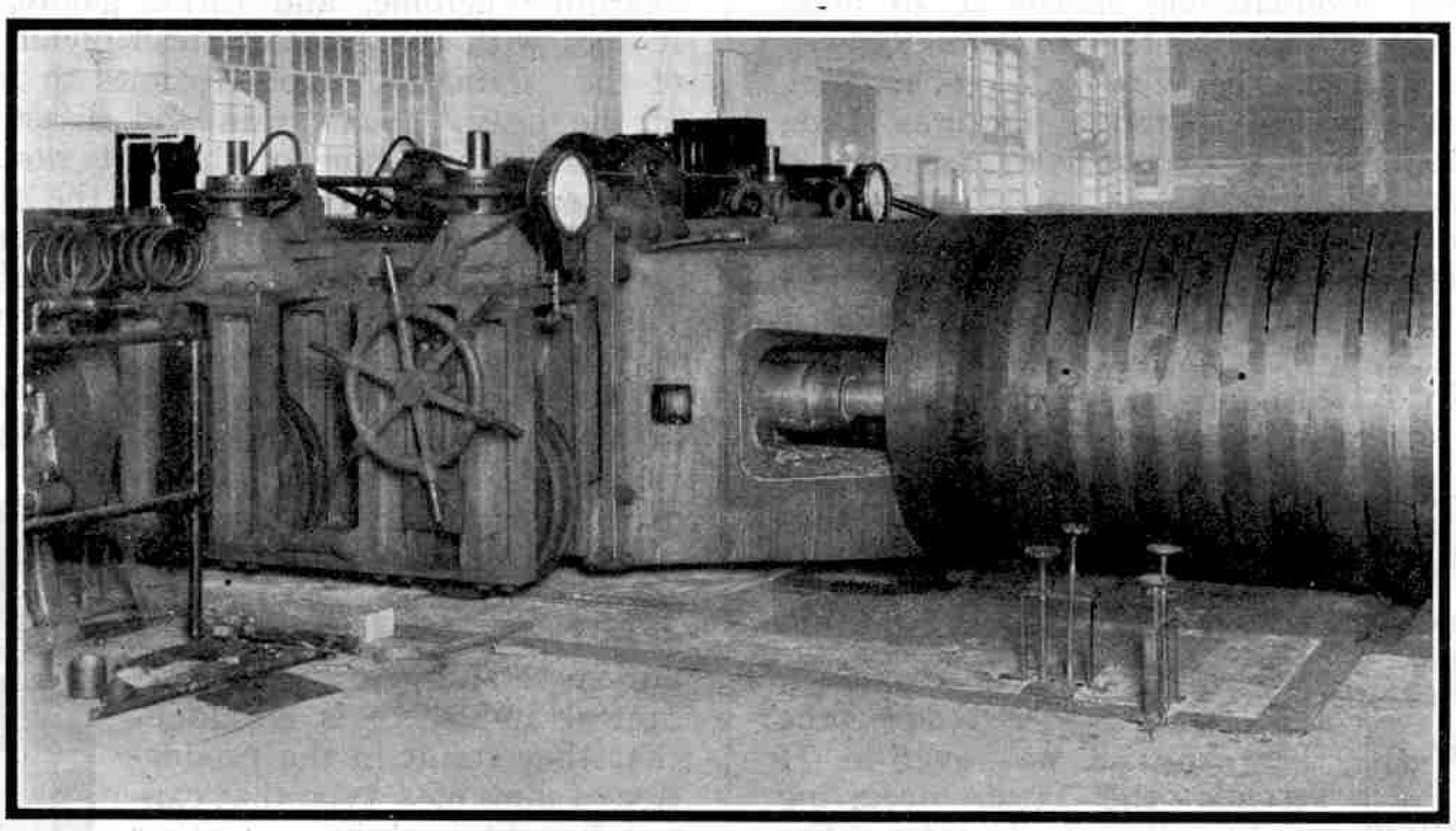
From the nozzle chambers of the high-pressure turbine the steam is expanded through the nozzles, and the energy from this expansion is absorbed by an impulse element. After leaving the impulse element the steam expands through 21 pairs of rows of reaction blading. Steam is extracted for feed-water heating from the zone between the 14th and 15th pairs of rows, and also at the turbine exhaust. The thrust towards the coupling end produced by the pressure drop across the reaction blading is counterbalanced by a two-step dummy and a Kingsbury thrust bearing.

The cylinder of the high-pressure turbine is of cast steel and is divided vertically into two sections to facilitate casting and machining. The cylinder is connected to the coupling-end pedestal by means of tie

rods, the pedestal being anchored rigidly to the foundation. A vertical key also connects the cylinder and coupling-end pedestal, permitting motion of the cylinder and pedestal relatively to one another in a vertical direction, while at the same time maintaining transverse alignment. The thrust-end housing and cylinder are connected by means of tie rods and a key, but the housing is free to slide on its pedestal, which is anchored to the foundation and centres the cylinder by means of a key. The cylinder is supported on four feet.

All the cylinder blades are mounted directly in the cylinder wall, while a separate ring is employed for the dummy's blades. The blading, both impulse and reaction, is of stainless steel and highly polished.

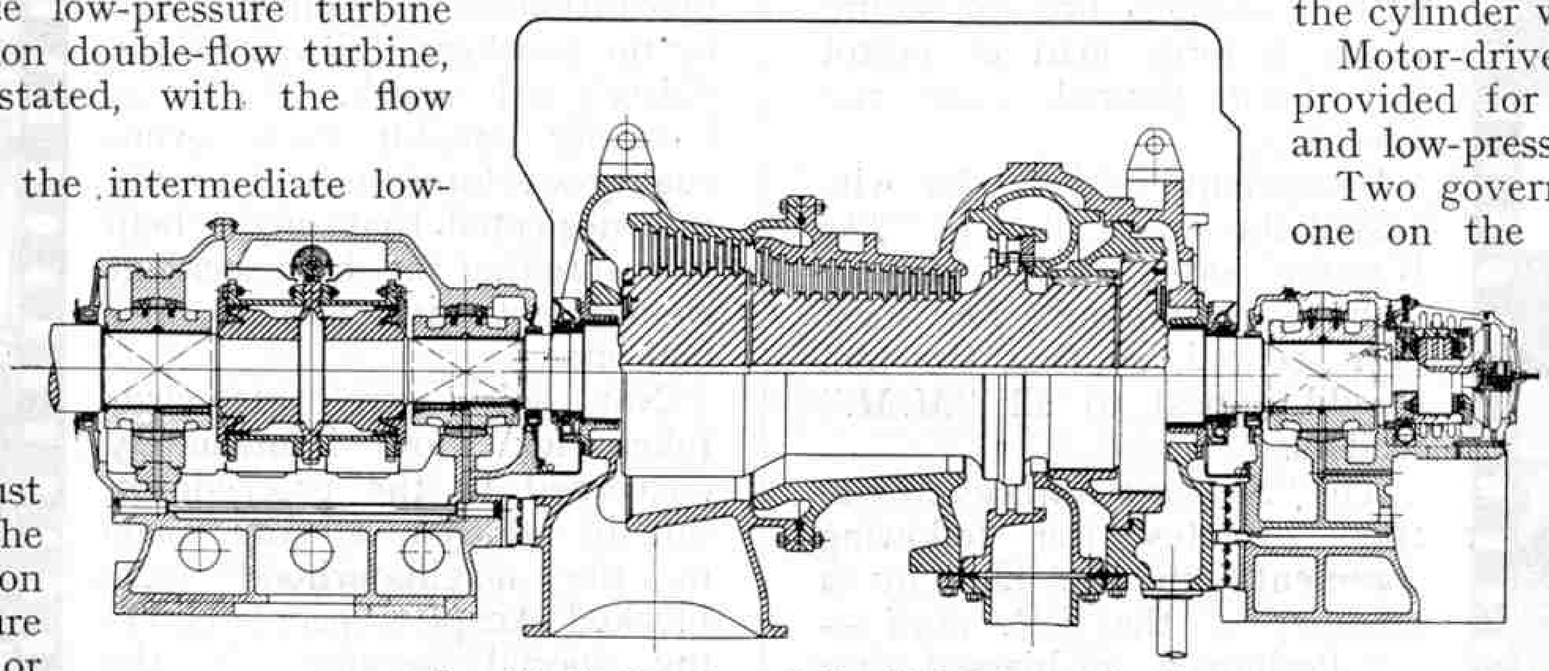
The spindle is a one-piece forging with an extension operated to the thrust end. This extension carries the oil governor pump and thrust bearing and automatic stop governor. An inspection hole, 4 in. in diameter, was made for the full length of the spindle, and a thorough examination of the interior of the spindle forging was made by means of a telescope specially constructed for the purpose in conjunction with a combination of prisms.



Bolt pulling machine, by means of which the alloy steel bolts holding together the shaft ends and plates of the rotor are tested for tensile strength.

The intermediate low-pressure turbine is a straight reaction double-flow turbine, but, as already stated, with the flow unequally divided.

The cylinder of the intermediate low-pressure turbine is composed of three sections, a centre section and two ends, each made up of a cover and base. The thrust end is the same as the corresponding portion of the low-pressure turbine, with minor modifications. As is the case with the high-pressure turbine, all cylinder blades are mounted in the cylinder wall. The centre section is constructed entirely of steel and the two end sections are of cast iron.



Longitudinal section of the high-pressure turbine.

A receiver pipe connects the outlet from the coupling end to the inlet of the low-pressure turbine. There are three expansion joints, one at the junction of the receiver pipe and low-pressure cylinder; one at the junction of the receiver pipe and intermediate low-pressure turbine cylinder; and one in the horizontal portion of the receiver pipe to allow axial movement between the turbine cylinders. These are of standard copper expansion joint design, with heavy links taking the collapsible forces, but allowing the combination of the three joints to act as a flexible unit.

The spindle of the intermediate and low-pressure turbines is a carbon steel forging of two pieces, the joint being made between the third and fourth pair of rows on the coupling end. Through the main body of this spindle extends an 8 in. inspection hole, which tapers down to 4 inches in diameter at each end.

Although the steam-flows through the two ends are unequal, the proportions are such that the maximum unbalanced thrust under normal operating conditions causes a very conservative loading on the thrust bearing. One half of the total steam-flow entering the low-pressure turbine passes through each end, expanding through seven pairs of rows of reaction blades to a vacuum of 29 in. of mercury. The cylinder for this turbine is also composed of three sections, a centre and two exhaust sections, each being made up of a cover and base, all three elements being of cast iron. As in the other two turbines all cylinder blades are mounted in the cylinder wall.

Motor-driven turning gear is provided for the high-pressure and low-pressure units.

Two governors are provided, one on the high-pressure and one on the low-pressure element. These are of the oil impeller type, and with an oil injector the governor serves also as the main oil pump. The arrangement is such that the impeller of the high-pressure governor does all the governing. The oil is discharged from this impeller at a pressure of 83 lb. to the sq. in. at normal speed, operating the relay valve only and supplying through an orifice approximately one-fourth of the bearing oil. The governor impeller of the low-pressure unit supplies oil at 80 lb. pressure to the operating pistons and through an orifice the remaining three-fourths of the total bearing oil. In addition to these two main governors there is an automatic stop governor provided on each element. These governors are set

(*Continued on page 140*)

"The Wrecker"

A Film for which the Southern Railway Acted

IN the *"M.M."* for August last we described the realistic railway level-crossing smash at 40 miles an hour that was arranged by the Southern Railway as part of a film called *"The Wrecker."* This film, which is a product of Gainsborough Pictures Ltd., has been completed, and is expected to be released shortly for public exhibition.

The scene chosen for this realistic "accident to order" was Salter's Ash Crossing, on the Basingstoke and Alton branch of the Southern Railway, and it involved the smash-up of a four-wheeled coupled express engine, No. A148, hauling a six-bogie set train. The preliminary arrangements occupied several weeks. No trouble was spared to make the smash realistic, and there was no doubt that in this respect complete success was achieved.

When the signal was given the train thundered down the slope and all was over in 71 seconds—the crash occurring at 40 miles an hour! The engine was absolutely wrecked, and the whole of the train was off the track with the exception of the last pair of wheels. Subsequently the dummy passengers, "dying" and "injured," were carried out, and the whole affair wound up with a glorious fire, to secure which a lorry load of petrol had been poured over the wreckage.

Competent critics who witnessed the Trade show of *"The Wrecker"* say that the railway scenes are among the finest ever secured, so that the film should appeal to all *"M.M."* readers.

The *"Southern Railway Magazine"* quotes the following comments on the film by a member of the S.R. staff:—

"Perhaps I am biassed after having seen so much of the preparatory work in connection with the filming of the different scenes which have been made on our line, but after witnessing the Trade show I am sure that *"The Wrecker"* will prove a great attraction to the public. Even if it were not connected with the railway itself, it is just the sort of picture to delight in—intrigue, a love interest, with an athletic young hero and a charming heroine, and thrills galore, finishing up as it does with the greatest thrill of all when the engine of the *"Rainbow"* express comes to rest within a foot of the heavy goods train and disaster is averted.

"But to say more of the plot would possibly spoil your enjoyment when you see the film."

The accompanying sections of the film are reproduced by courtesy of the *"Southern Railway Magazine."* The section on the left-hand side of the page depicts various stages of the "accident."

The Southern Railway Company can claim the distinction of being the first British railway company to collaborate with a motion picture company with the object of staging a realistic and thrilling railway smash. Faked disasters of this nature have been carried out successfully in the United States, and there is no doubt that they result in the production of films of a type that cannot be obtained in any other manner, and in which the realism is quite startling in its intensity.

It is quite clear that a certain element of danger must always exist for those who take part in such "stunts," and in this connection it is interesting to note the completeness of the precautionary measures taken by the Southern Railway for the Salter's Ash smash. As far as humanly possible every eventuality was foreseen, and no step was neglected that might help to ensure that the sham accident should not give rise to any real ones.

Not only were safeguards taken for those immediately concerned in the proceedings, but in addition all the roads in the neighbourhood were blocked except to people carrying special permits for the occasion. In addition a large force of Hampshire police and St. John's Ambulance men were present to keep the public, who were naturally very curious, out of the danger zone.

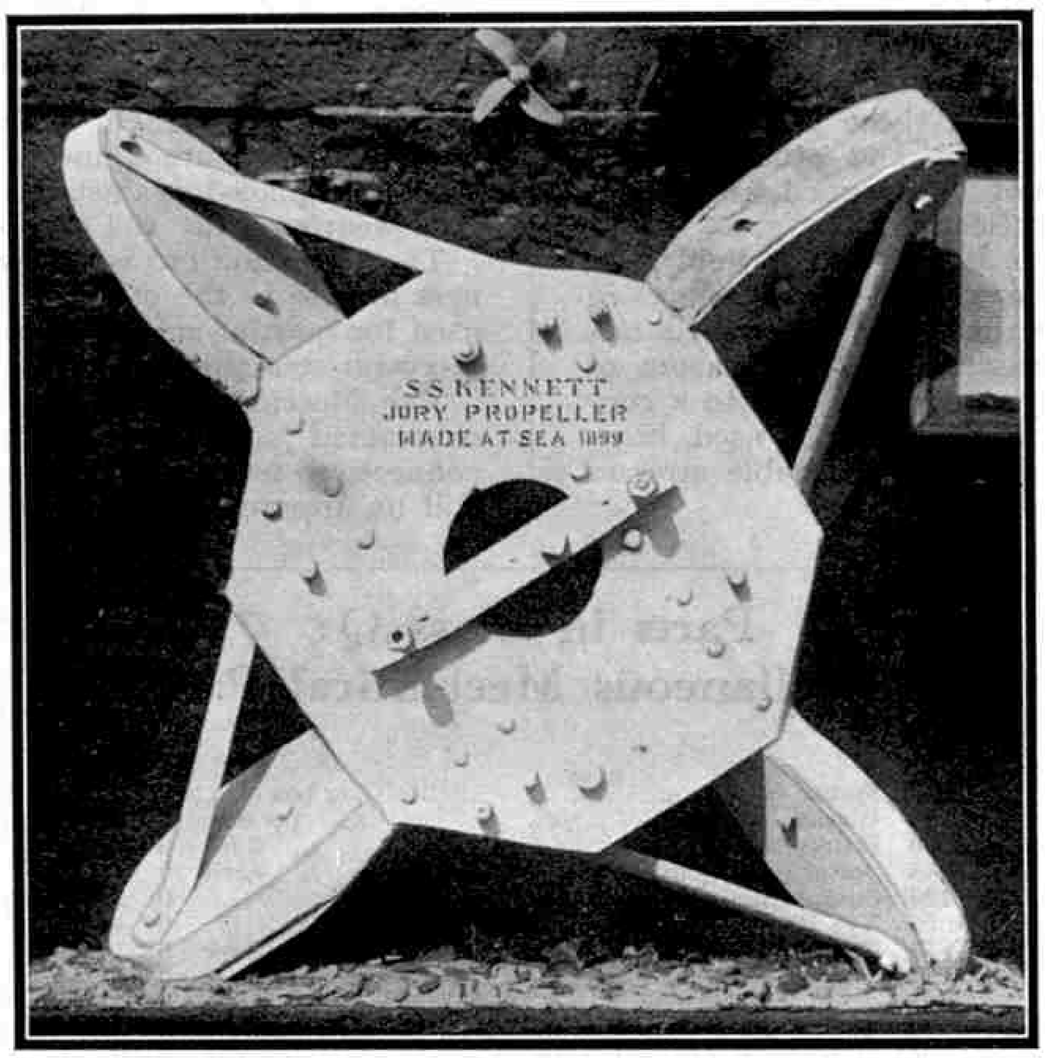
It is very gratifying to be able to record that the precautions taken were completely successful, and that throughout the proceedings no hitch of any kind occurred.

A Propeller Made at Sea

Interesting Feat by a Resourceful Engineer

By G. E. Moore, A.M.I.E.E.

WHILE on a business visit to the yard of the Mercantile Dry Dock Company at Jarrow-on-Tyne, my attention was attracted by a curious structure mounted opposite the main gate. This proved to be a "jury propeller," and on inquiry I learned that an exceedingly interesting story was connected with it. It had recently been painted white and, against a tarred background with the sun shining full upon it, it formed a subject that tempted me to use my camera, with the result seen in the accompanying photograph.



Photograph of the jury propeller made at sea, and now preserved at the yard of the Mercantile Dry Dock Co., Jarrow-on-Tyne.

In 1899 the steamship "*Kennett*" was well out at sea when the tail end shaft broke away, carrying with it the propeller. There was a spare propeller on board, but although this could have been fitted on the stump of the shaft there was no means of securing it in place by the usual nut. This was a serious state of affairs, but the Chief Engineer was not one to give up easily and he put on his "thinking cap." Eventually he decided to make a special propeller that *could* be fixed with the means at his disposal.

Perhaps only an engineer—and a sea-going engineer especially—can fully realise what such a startling decision meant. Aboard a ship like the "*Kennett*" there would be none of the complicated machines and appliances for casting and finishing-off a thing like a ship's screw. What the ingenious engineer did was to improvise the weird-looking jury propeller from such materials as he had, and with the limited workshop means at hand.

The boss (central portion) was made of iron plates cut from bunker doors, between which was 6 in. of concrete. Each blade of the propeller was of 3-in. wood held by thin iron plates, and was 1 ft. 8 in. in length by 10 in. in width; it was roughly tapered at each end. The blades were set suitably askew in the boss, the pitch being $8\frac{1}{2}$ in., and in order to make sure that they would remain firmly seated a stay was carried from the tip of each. The whole propeller was 6 ft. 6 in. in diameter.

So far, so good. The really difficult part of the work lay in making it possible to fit this screw to the shaft, which had fractured inside the boss of the lost propeller. The second illustration will make clear the situation, and how the engineer met it.

The original keyways were made use of, and so the hole through the boss was given two slots in order to fit the keys. Thus the propeller, as regards turning on the shaft, was securely locked. In order to hold it on, a special slot was cut across the broken end of the shaft and in this two screwed studs were fitted. Needless to say this work was done with tremendous difficulty and under uncomfortable conditions. Across the hole in the boss was affixed a bar of iron having two holes to receive the studs. When the propeller was actually mounted the bar dropped into the special shaft slot and nuts were run on the studs projecting through the holes in the cross bar. The propeller was by this method completely secured.

It has not taken long to describe how the crude ship's screw came into being and was fitted, but the actual work took no less than 16 days. It was successful, however. No risks were taken when the ship was once more under way. The speed was kept low and, helped by the sails, the S.S. "*Kennett*" travelled 1,200 miles at four knots to the Barbadoes. There proper repairs were carried out, and the jury propeller went into honoured retirement.

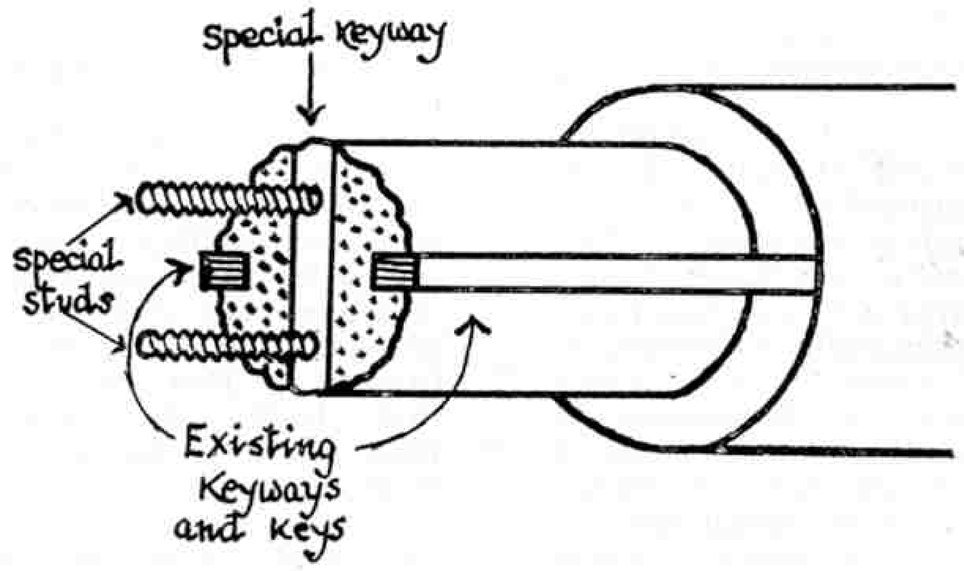
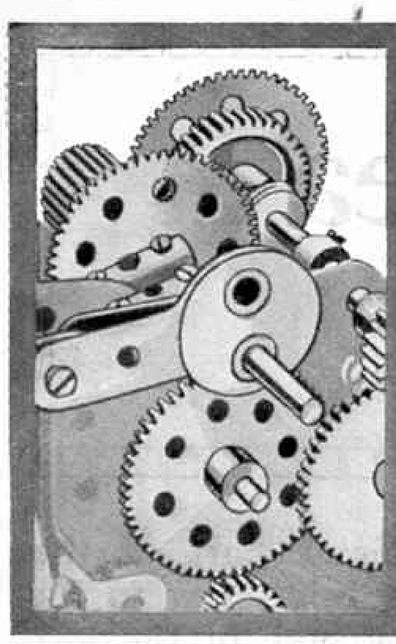
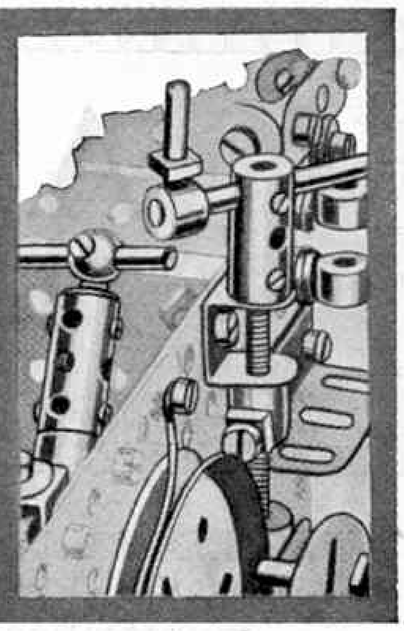


Diagram showing how the propeller was fitted to the shaft.

No one seems to know the resourceful engineer's name now, but I think we can all take our hats off to him for a splendid feat. He was a worthy representative of a profession the members of which are not in the public eye to the extent that they often deserve. A marine engineer works below decks, but may play as great a part in ensuring the safety or success of a vessel as the captain himself, for he combines the mechanical knowledge of an ordinary engineer with the traditional handiness and resource of the sailor.



HOW TO USE Meccano Parts



XII.—Miscellaneous Parts (Class Q)

For the purpose of this series of articles we have grouped all the Meccano parts into two main sections, termed the Structural and Mechanical Sections, and these sections have been further divided into a number of separate classes. The complete grouping is as follows. Structural Section: Class A, Strips; Class B, Girders; Class C, Brackets, Trunnions, etc.; Class D, Plates, Boilers, etc.; Class E, Nuts and Bolts, Tools and Literature, Mechanical Section: Class M, Rods, Cranks and Couplings; Class N, Wheels, Pulleys, Bearings, etc.; Class O, Gears and Toothed Parts; Class P, Special Accessories; Class Q, Miscellaneous Mechanical Parts; Class T, Electrical Parts; Class X, Motors, Accumulators, etc.

IT will be recalled that Class Q comprises those parts that are used in the construction of gear boxes and other working features of a model and yet cannot be grouped under any of the other Classes in the Mechanical Section.

Part No. 35 in this Class, Spring Clip, is designed to hold Axle Rods in position in their bearings or to maintain loose parts in place on the Rods. Both these functions can be carried out more efficiently by the Collar with Set-screw, but for reasons of economy Meccano boys usually employ the Spring Clip to a considerable extent in the larger models. It can only be used, however, for light work; in every case where considerable stresses are met with a Collar should be used.

Novel Friction Clutch

A very ingenious use for the Spring Clip was incorporated recently in a small Meccano Clock. In this model the Gear Wheel that transmits the drive to the minute hand and, through further reduction gearing, to the hour hand, is not secured directly to its Rod, but carries bolted to its face an Angle Bracket, the flange of which engages with the arms of a Spring Clip mounted on the Rod. Hence the drive from the Gear Wheel is directed to the Rod through the Spring Clip, so that if the hands are turned in resetting the Clock, the Rod is able to slip round in the Spring Clip without turning the Gear Wheel. On the other hand, when the clock is set in motion, the "stiffness" of the Spring Clip on the Rod is quite sufficient to transmit the power of the main spring to the hands. Many Meccano boys use a similar arrangement to this as a safety device to prevent too great a load being thrown on a Meccano Electric Motor.

In the mechanism shown in Fig. 1 it was required to mount the Rod 5 so that it could be moved longitudinally in its bearings, but not rotated. Consequently two Spring Clips were placed upon it with their arms towards the Double Angle Strip in which the Rod is mounted, with the result that, should the Rod start to turn, they strike against the Strip and prevent further movement.

The Washers (No. 38) are designed principally, of course, to decrease friction between moving parts. They are also invaluable for spacing purposes. A single Washer is approximately equal in thickness to an ordinary Meccano Strip; hence it frequently proves invaluable for obtaining correct spacing when building various Meccano structures. For example, a Meccano Plate may be secured to an Angle Girder by a bolt at each end, but one of the bolts may have a Strip placed upon it between the Plate and the Girder. Then, if the Plate is to lie perfectly parallel to the Girder, a Washer must be placed between the two parts on the other bolt.

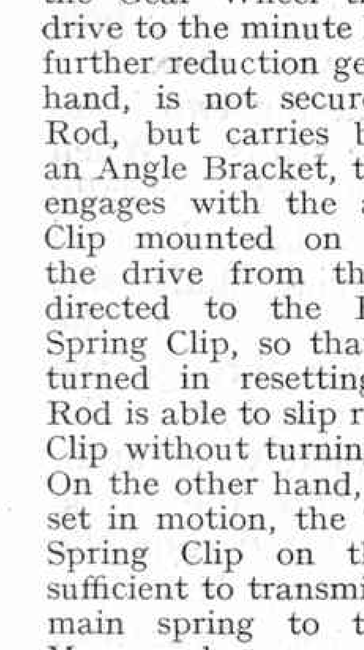


Fig. 1

Many model-builders make a rule of placing a Washer immediately underneath the head of any bolt that is passed through an elongated hole, such as those in the wider flanges of the Angle Girders, etc., in order to obtain a better grip. If two enamelled parts are connected pivotally by bolt and nut, Washers should be placed against the parts to prevent the bolt head and nuts wearing away the enamel.

The Meccano Cord is red in colour and of the appropriate thickness for use in the majority of models. It is strong and may be used for hoisting mechanisms, pulley and belt gear, or for bracing Meccano structures and any other similar purposes.

The Meccano tension Spring (No. 43) measures 2″ in length contracted and is fitted with a loop at each end to facilitate its connection to other Meccano parts. Its functions as a spring will be apparent to every Meccano boy. A somewhat novel use for the part is included in Fig. 2, where it may be seen at 79 mounted on the buffer beam of the Meccano Tank Locomotive (see Special Instruction Leaflet No. 15) to represent the vacuum brake pipe connection. The Spring is frequently used in models of petrol and steam engines for a similar purpose, i.e., to represent a pipe.

Parts in Class Q: Miscellaneous Mechanical Parts

Part No.		Prices s.	d.
35	Spring Clips ... ... per box (doz.)	0	3
38	Washers ... ... per doz.	0	1
40	Hanks of Cord ... ... 2 for	0	3
43	Springs (tension) ... ... each	0	2
120b	Compression Springs ... ... „	0	1
50a	Eye Pieces, with boss ... ... „	0	4
57	Hooks ... ... 2 for	0	1
57a	„ Scientific ... ... each	0	1
57b	„ Loaded ... ... „	0	3
58	Spring Cord ... ...per 40″ length	0	9
58a	Coupling Screws, for Spring Cord... ... ...per doz.	0	6
59	Collars with Set-screws ... ... 2 for	0	3
64	Threaded Bosses ... ... each	0	2
65	Centre Forks ... ... „	0	1
94	Sprocket Chain ... ... per 40″ length	0	6
115	Threaded Pins ... ... each	0	2
116	Fork Pieces, large ... ... „	0	3
116a	„ „ small ... ... „	0	3
130	Triple Throw Eccentrics (¼″, ⅜″, and ½″ throws) „	1	0
170	Eccentric, ¼″ throw ... ... „	0	9
136	Handrail Supports ... ... „	0	3

The Compression Spring 4 in Fig. 6 is placed over the shanks of two opposite ⅜″ Bolts and acts as a shock absorber for both axles attached to the 2½″ Strip.

A Compression Spring does important service in the clutch of the Meccano Motor Chassis. The clutch was reproduced at Fig. 10 in last month's article, and if reference is made to that illustration it will be seen that the Spring holds the clutch member 3 in engagement with the member 1 until the operating pedal is pressed. The Spring is placed between the Collar, which is fixed to the Rod, and the Flanged Wheel, which is free on the Rod. In this case, however, the ordinary Compression Spring would be too large to go in the small space available; it is therefore cut in two, by means of pliers, etc., and a portion only used.

The Eye Piece, which is now supplied complete with boss, is particularly useful as a guide for sliding mechanisms, such as an engine crosshead. The slotted portion will fit over any Meccano Strip, which thus becomes a guide rail. Fig. 4 shows the crosshead of a Meccano horizontal steam engine, in which the two Eye Pieces 4 act as "slippers" sliding on the "guide bars" 3.

The ordinary Meccano Hooks (No. 57) require little explanation. They are

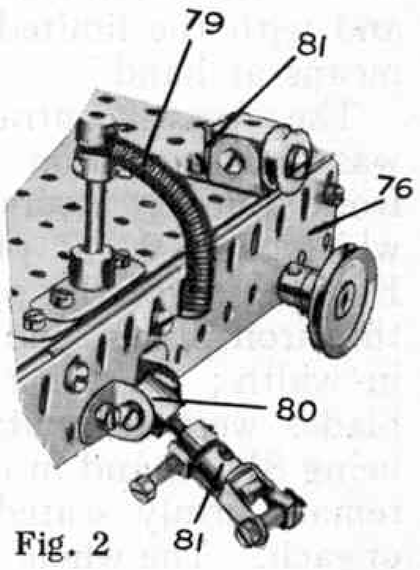


Fig. 2

Reliable Safety Catch

The Compression Spring normally measures ½″ in length, and is used to control movement and as a shock absorber, etc. In Fig. 5 a Compression Spring 3 is placed on a Crank Handle so that normally a Collar 2 having an ordinary bolt inserted in its set-screw hole, is held against the bearing and the Crank Handle is prevented from rotating by the stop 5. The Handle can only be turned by compressing the Spring; hence an efficient safety device is provided.

of a suitable size for use as the load hooks in the majority of Meccano cranes. The Scientific Hooks (No. 57a) are provided for the benefit of those boys who wish to carry out delicate scientific experiments, wherein it is required to add accurately-measured weights to some portion of a model, and where it is important that the hook used to attach the weights should have as little effect on the moving parts as possible. The lower portion of the hook is straight and long so that three or four Meccano Weights (parts Nos. 66 and 67) may be added at one time.

The Loaded Hook (No. 57b) is an improvement on part No. 57. It is of much more massive construction and is complete with a lead ball, the weight of which is intended to keep the hoisting cord of a crane taut round the circumference of the guide Pulley when no load is attached to the hook, and when lowering, etc.

The Spring Cord has many varied uses. First, of course, is its function as a driving belt between two Pulleys. To make an endless driving belt, the necessary length of Spring Cord should be measured and cut off (by means of a pair of scissors, wire-cutters, etc.) and the two ends then connected together by means of the special Coupling Screw (part No. 58a), which has only recently been introduced for this purpose. The Coupling Screw is 3/32″ long and is provided with a thread of such a pitch that when it is screwed into the end of the Spring Cord the thread engages with the turns of the spring. The screw should of course be inserted half-way into one end of the Spring Cord, and the other end then screwed upon it in the same way as a nut is screwed on to a bolt. Once the Coupling Screw is inserted the Cord cannot be removed merely by unscrewing; the ends can only be separated by pulling them apart forcibly. Driving belts so constructed can only be used where very light stresses obtain, although the efficiency of the drive can, of course, be improved by duplicating the pulleys and belts.

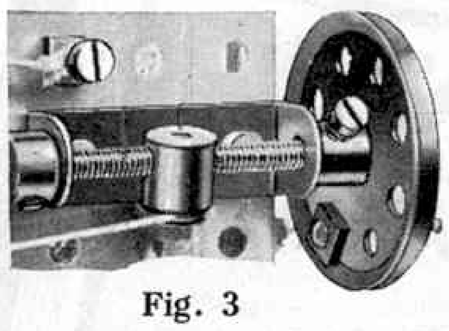


Fig. 3

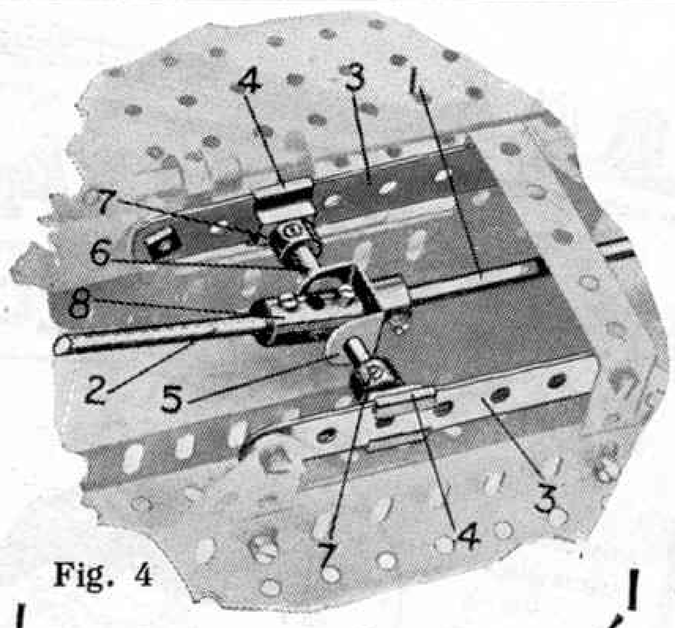


Fig. 4

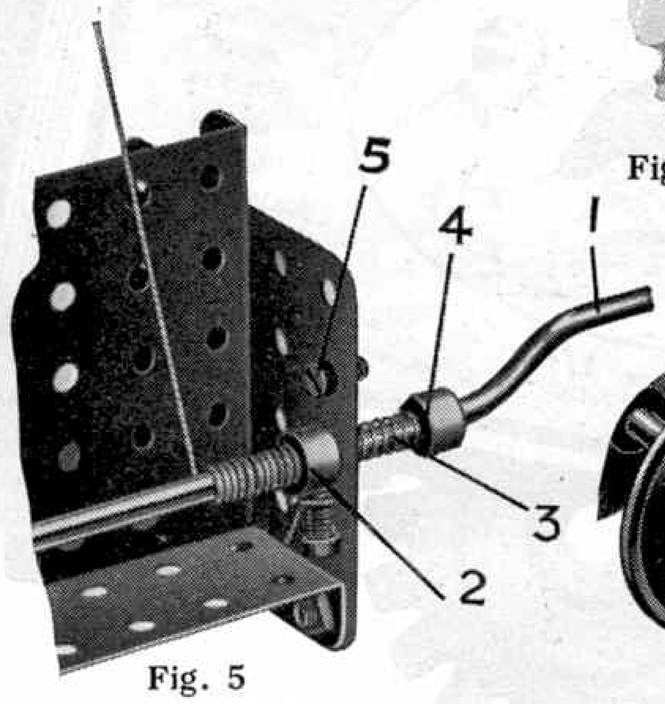


Fig. 5

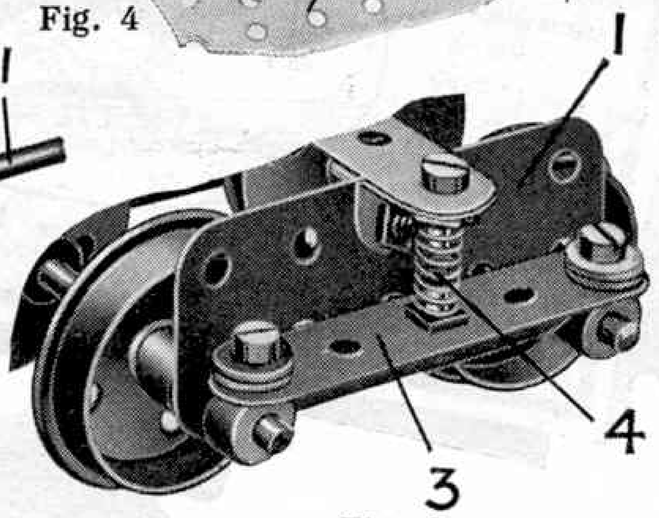


Fig. 6

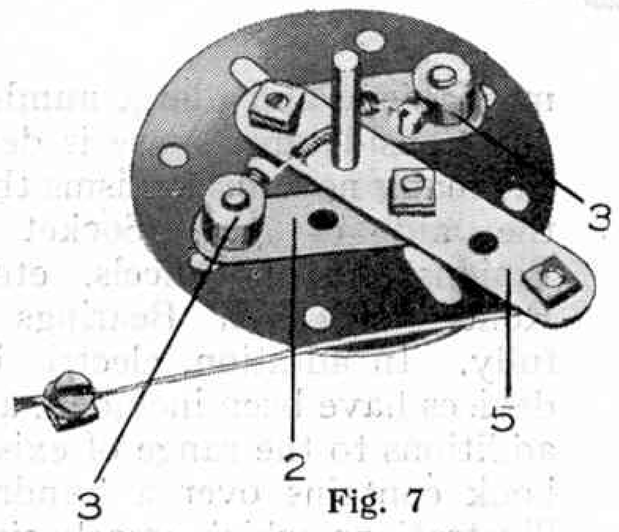


Fig. 7

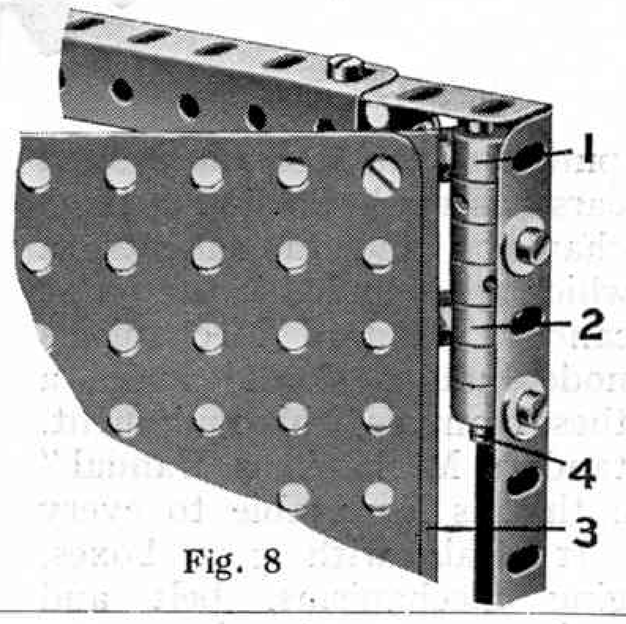


Fig. 8

Fixing Spring Cord

Where it is required to attach Spring Cord to a Meccano bolt or other part, its end should be heated in a lighted match so as to take the springiness out of the metal. It may then be twisted round the bolt as easily as a piece of thread.

Occasionally the Spring Cord is used as a kind of Bowden wire or cable to encase an operating wire or string. In article No. IV in this series, which appeared in the May, 1929, "*M.M.*," we illustrated a Meccano siphon lubricator, in which the "wicks" used to conduct the oil to the journal bearings were encased in short lengths of Spring Cord.

Yet another example of the adaptability of the Spring Cord will be found in Standard Mechanism No. 115 (Meccano Electric Controller) which was reproduced at Fig. 11 last month. In this case the Spring Cord is used as resistance wire, and short lengths of it are connected between the studs on the switch. Portions of the Spring Cord may also be used as tension springs for light purposes. Small springs so formed are used frequently, for example, for holding Pawls in engagement with Ratchet Wheels (see Fig. 15). Again, in the internal-expanding brakes fitted to the Meccano Motor Chassis (see Special Instruction Leaflet No. 1) short pieces of Spring Cord serve to return the brake shoes to the "off" position when the lever is released. Part of the brake mechanism is reproduced at Fig. 7, wherein a small piece of Spring Cord can be seen connected between ordinary bolts inserted in the set-screw holes of the Collars 3 that form the brake shoes.

The Collars with Set-screws, like the Spring Clips, are intended for holding shafts in place in their bearings, or for holding Strips, etc., loosely on Axle Rods. There are, however, many other novel uses for them. For instance, it has just been mentioned that they form the brake shoes of the internal-expanding brake shown in Fig. 7, whilst in Fig. 6 Collars secured to the 2½″ Strip 3 form journal bearings for axles. The bolts holding the Collars are spaced by Washers so that they do not grip the axles. In Fig. 8 a series of Collars are employed to form a hinge, the Collars 1 and 2 being secured to the door 3 whilst two other Collars are secured to the jamb and to the Rod 4. The remaining three Collars are inserted for spacing purposes.

The Threaded Boss is of the same diameter as the Collar but measures ⅜″ in length and is perforated longitudinally and transversely with threaded bores. Hence the part is particularly valuable in Meccano screw gearing. In Fig. 3 a Threaded Boss is shown mounted on a short Screwed Rod. It is prevented from rotating with the Rod; consequently, when the hand wheel is turned, the Boss travels longitudinally, and in the example illustrated this movement is utilised to control a simple brake mechanism.

In Fig. 2 the Threaded Boss 80 serves to attach the Coupling unit to the front buffer beam of the Meccano Tank Locomotive. The 1″ Screwed Rod that carries the unit 81 (a small Fork Piece fitted with ⅜″ Bolt) is inserted in one end of the Threaded Boss and two bolts passed through Angle Brackets are inserted in opposite sides of the Boss and thus hold it pivotally to the buffer beam. The Threaded Boss is also useful for connecting Strips and other parts to Screwed Rods. The Strips may be secured to the Boss by inserting ordinary bolts in its threaded bores.

The Centre Fork may be used as a small pointer in certain Meccano indicating appliances, etc. Perhaps its most important function, however, is its use in intermittent motion, where it engages at intervals with the teeth of a Meccano Gear or Sprocket Wheel. It is shown used in this way in a Meccano distance indicator in Fig. 14. Here the Centre Fork is secured by a Coupling to a vertical rotating Rod, in such a way that once in each revolution of this Rod it engages with and partially turns a Sprocket secured to a second vertical Rod. The first Rod might be used for counting units and the second Rod tens, and to effect this the Centre Fork should be so adjusted that it moves the Sprocket through 1/10″ of a revolution each time it engages with it.

Constructing a Meccano "Knife-edge" Bearing

A somewhat novel use for the Centre Fork is illustrated in Fig. 10. Here it forms the "knife edge" in a Meccano knife-edge bearing. As most Meccano boys will know, the knife-edge is employed wherever it is necessary to reduce friction in a moving lever to an absolute minimum. Fig. 10 is a section of the Meccano

YOU *must have this Manual*

MECCANO "STANDARD MECHANISMS"

The great development of the Meccano system during the last few years has made possible a large number of new mechanisms and movements, a splendid selection of which are included in the latest edition of the Meccano "Standard Mechanisms Manual." Every model-builder should make a point of adding one of these manuals to his equipment.

The Meccano "Standard Mechanisms Manual" is full of information that is invaluable to every keen Meccano boy. It deals with gear boxes, clutches, drive-changing mechanisms, belt and pulley mechanisms, levers, brakes of all types, screw mechanisms and a large number of other movements.

Considerable space is devoted to particulars of the many new mechanisms that can be devised with the aid of the Socket Coupling, elongated Pinions, Bevel Wheels, etc. The uses of the Roller and Ball Bearings are also dealt with fully. In addition, electric braking and governing devices have been included, and these form valuable additions to the range of existing mechanisms. The book contains over a hundred beautiful half-tone illustrations, which greatly simplify the construction of the more complicated movements.

HOW TO OBTAIN THE MANUAL

The Meccano "Standard Mechanisms Manual" may be obtained from any Meccano dealer, price 1/–, or direct from Meccano Ltd., Old Swan, Liverpool, price 1/1½ post free.

There is a special edition for Overseas, price 1/6 from dealers, or 1/8 post free from the agents (Canadian price 35 cents from dealers or 38 cents post free, from Toronto).

Readers in Australia, New Zealand, South Africa or Canada who require copies should apply to their dealers or should address their orders to our agencies as detailed below. Readers living in countries other than those mentioned should order from Meccano Ltd., Old Swan, Liverpool, sending a remittance of 1/1½ with their order.

Australia : E. G. Page & Co., 52, Clarence Street, Sydney. (P.O. Box 1832).

New Zealand : Models Ltd., Kingston Street, Auckland. (P.O. Box 129).

South Africa : Arthur E. Harris, 142, Market Street, Johannesburg. (P.O. Box 1199).

Canada : Meccano Ltd., 34, St. Patrick Street, Toronto.

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Harmonograph (see Special Instruction Leaflet No. 26) the Pinion 16 being secured to the pendulum. This Pinion rests upon the edge of the Centre Fork 17, the teeth of which lie between two of the teeth in the Pinion, and the Centre Fork is secured in the boss of a Crank 18 that is bolted to the fixed part of the model. The pendulum rocks about the extreme edge of the Centre Fork.

The primary function of the Sprocket Chain is, of course, to provide a means of transmitting power between any two shafts where ordinary gearing would be impracticable and belt or cord drive insufficiently positive. It engages with the Meccano Sprocket Wheels, of which there are five different sizes. The Sprocket Wheels and the different speed ratios that are obtainable with their aid, were described at length in the article in this series dealing with Class 0 (Gears and Toothed Parts) which appeared in the September, 1929 "*M.M.*"

The Chain is supplied in lengths of 40 ins., and comprises 12 links to the inch. It may easily be separated and joined again when the requisite length has been measured off. To separate, the ends of one of the links should be gently prised up with the blade of a screwdriver so that the adjacent link may be slipped out. After rejoining, the ends should be bent back again carefully so that they do not grip the next link too tightly, and care should be taken to see that all the links remain of the correct shape to pass easily round the teeth of the Sprockets. The Chain should be passed round the wheels so that the turned-over ends of the links face outward or away from the wheel, as this will result in smoother running.

Chain Gearing

Sprocket Chain may also be used for operating a shaft by hand power, an endless length of chain being passed round a Sprocket Wheel on the shaft, which is turned on hauling upon one side of the chain. An example of this kind of operating gear is shown under detail No. 203 in the Standard Mechanisms Manual. The same detail includes a novel hoist gear constructed with the aid of the Sprocket Chain. In this gear a length of Chain is passed round a Sprocket that is secured to a shaft driven through Worm gear, and one of its ends, depending from the Sprocket, is attached to the load hook. A novel driving gear making use of Sprocket Chain was illustrated in Fig. 2 in the "How to Use Meccano Parts" article in the "*M.M.*" for November last.

The smooth portion of the Threaded Pin, which is of a standard diameter with the Meccano Axle Rods, terminates in a squared shoulder and short threaded shank. Until recently the shoulder was rounded instead of squared, but the new shape constitutes an important improvement in that it permits of the Pin being secured rigidly with the aid of a spanner. The part is intended principally for use as a handle or as a fixed pivot for a $\frac{1}{2}$" or 1" loose Pulley. In Fig. 9 two Threaded Pins 11 and 14 are used as handles for operating sliding Axle Rods, the Pins being secured to the Rods with the aid of Collars. Another kind of handle, formed from two Threaded Pins and a Collar, is shown in Fig. 11, whilst in Fig. 15 a Threaded Pin is seen inserted in the set-screw hole of a Pawl, to serve as a handle by which the Pawl may be lifted clear of the Ratchet Wheel.

The Fork Pieces (large and small) are designed for pivotal connections between Rods and Strips or between two Rods meeting at right angles. In Fig. 4 a Large Fork Piece forms a connection between the piston rod 1 and the cross piece 6, whilst in Fig. 9 the same part may be seen employed as a neat journal bearing for a short horizontal Rod. The Small Fork Piece in Fig. 2 has already been alluded to; In Fig. 12 this part is seen employed as a bearing for a $\frac{1}{2}$" loose Pulley, which is free to run on a $\frac{1}{2}$" Bolt passed through its arms.

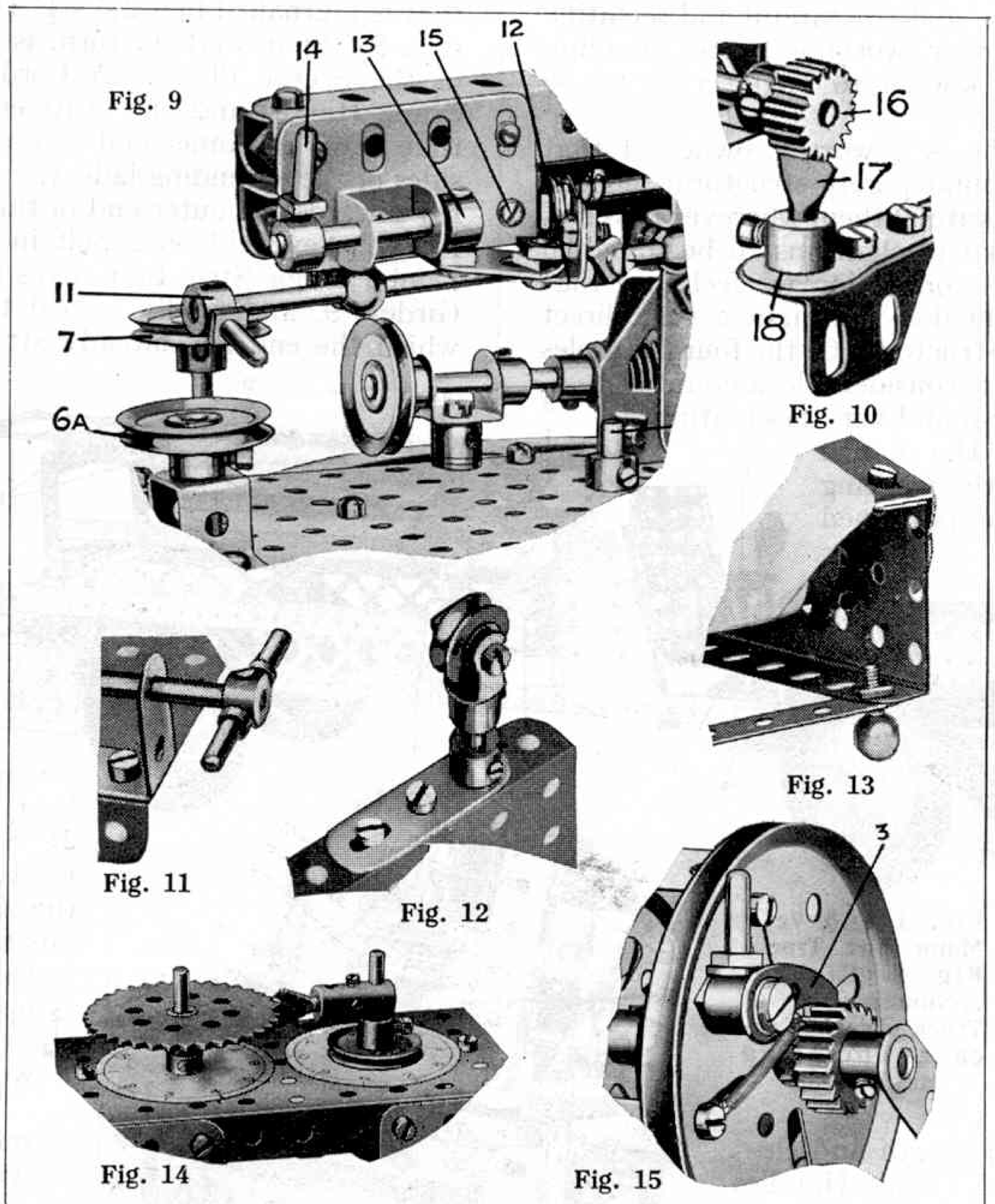


Fig. 9

Fig. 10

Fig. 13

Fig. 11

Fig. 12

Fig. 14

Fig. 15

Uses and Advantages of Eccentrics

There are two kinds of Meccano Eccentrics, part No. 130 giving three different throws ($\frac{1}{4}$", $\frac{3}{8}$", and $\frac{1}{2}$") and No. 170 one throw only ($\frac{1}{4}$"). The term "throw" means the radius of eccentricity, so that the total rectilinear movements obtained for the three throws of No. 130 are $\frac{1}{2}$", $\frac{3}{4}$", and 1" respectively, while that of No. 170 is $\frac{1}{2}$".

The great advantage of an eccentric is the fact that it permits reciprocating movements being obtained from a rotating shaft without breaking the line of the latter. On the other hand a disadvantage lies in the fact that unlike the crank, it can only transform rotary movement to reciprocating and cannot be used to produce rotary motion from a reciprocating motion. In Meccano model-building, as in actual engineering, the most common use for the eccentric is found in the operation of valve mechanism for reciprocating engines. The $\frac{1}{4}$" Throw Eccentric is employed to produce the valve movement on the Meccano Traction Engine (see Special Instruction Leaflet No. 22), while the Triple Throw Eccentric is used in the Meccano Horizontal Steam Engine (see Instruction Leaflet No. 11) and in the Vertical Steam Engine (Manual Model No. 6.13). The arm of either type of Eccentric may be extended by bolting a Meccano Strip to it or connecting it to an Axle Rod with the aid of a Strip Coupling. An Eccentric requires ample lubrication.

The Handrail Support, in addition to the function indicated by its name, may be employed as a journal bearing for rotating shafts. When used for this purpose, however, great care must be taken in mounting the support to prevent binding on the shaft. If mounted properly, ample bearing surfaces are provided. In Fig. 9 the part is seen employed as a bearing for the sliding Rod carrying the handle 11.

In addition, the Handrail Support may of course be used in innumerable cases where it is required to secure an Axle Rod to a Strip or other part. Another very different use for the Handrail support is indicated in Fig. 13, where it is shown used as a foot-support for a desk agenda. The great advantage obtained from using foot-supports of this type lies in the fact that the smooth, rounded surface of the Handrail Support allows a model so equipped to be placed on highly polished surfaces without fear of causing scratches, which, of course, is a particularly important consideration in the case of a desk agenda. The Handrail Supports are used also to a large extent as ornamental tops for columns; for this purpose, their shanks usually are screwed into the longitudinal tapped bores of Threaded Couplings, which may then be secured on Axle Rods.

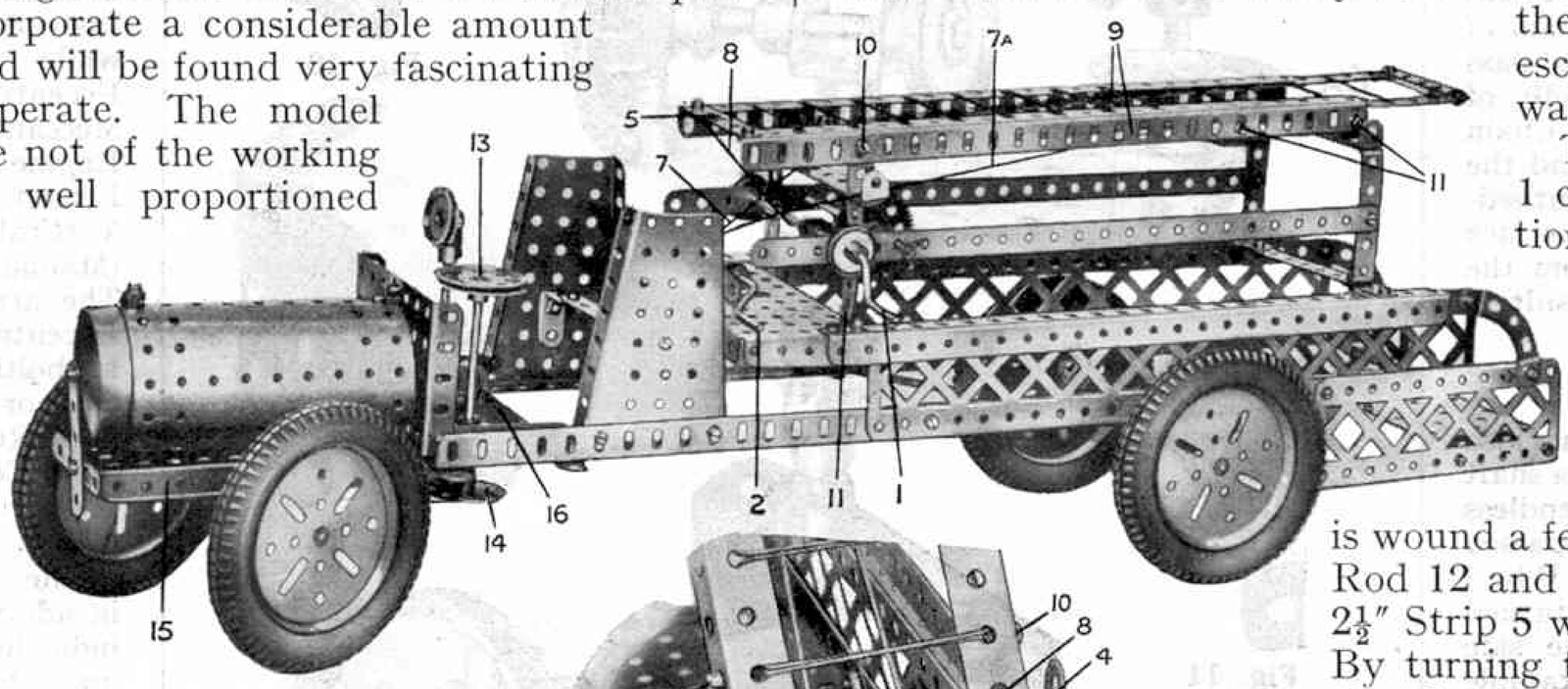
Perhaps the most novel use of the Handrail Support is that suggested recently by a Meccano boy who hit upon the idea of building a Meccano model of a deep sea diver. He purposely made the model so small that a Handrail Support could be used for the diver's helmet, which it resembles very closely. A Coupling formed the body of the diver, and long bolts, etc., represented his arms and legs, whilst the tube that was supposed to supply him with air from the surface was formed by a length of Spring Cord.

New Meccano Models

Fire Truck—Knife Grinder—Single Engine Monoplane—Speed Indicator

THE great popularity of the Meccano system as a model-building medium may be said to be due to two main factors; the remarkable adaptability brought about by the standardisation of the ½" equi-distant spacing of all holes, and the careful and scientific selection of gears and other working parts, enabling almost every movement known to engineering to be reproduced.

The Meccano boy (if he is a worthy owner of that title !) is not content to build purely structural models, but endeavours to incorporate in them wherever possible, reproductions of the actual mechanisms to be found in their prototypes. In this connection we feel sure that this month's selection of models will make a very direct appeal to the average constructor. Of the four examples shown three incorporate a considerable amount of mechanism and will be found very fascinating to build and operate. The model monoplane, while not of the working type, forms a well proportioned "shell" on which the model-builder may demonstrate his mechanical ability by fitting motive power (a Meccano Clockwork Motor or "rubber torsion engine" for instance).



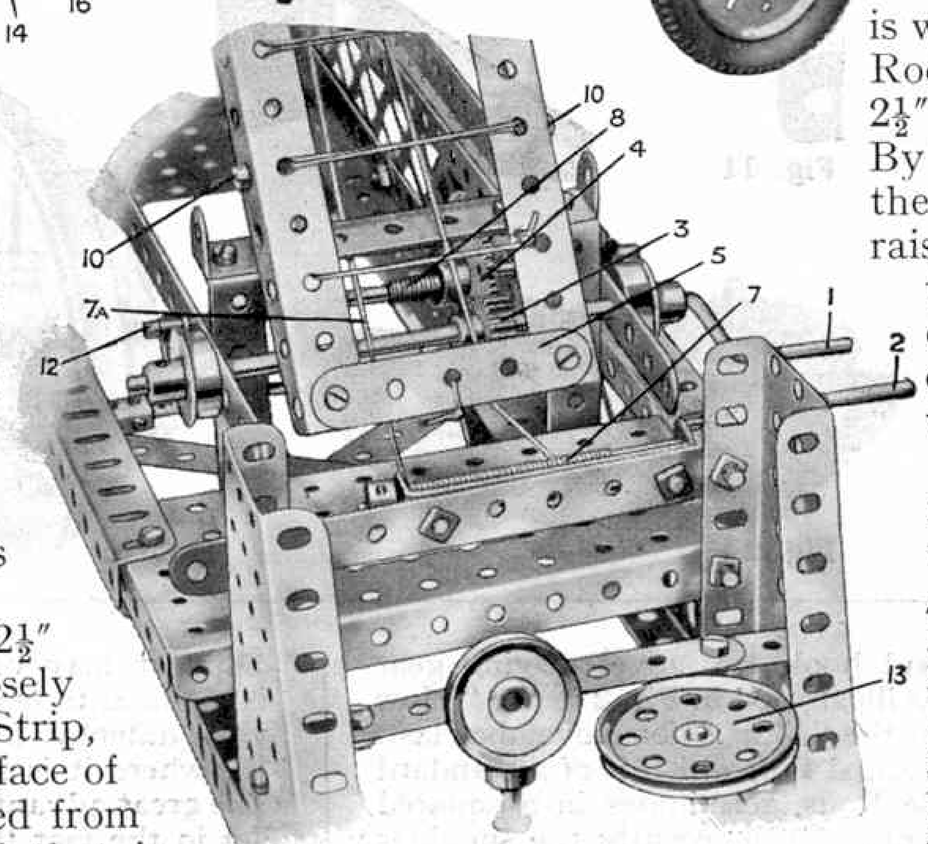


Fig. 1 (Above): Motor Fire Truck. Fig. 2 (Right): Sectional view of Truck showing escape operating mechanism.

Fire Truck

The model fire truck shown in Fig. 1 incorporates a fire escape that may be adjusted for length and elevation, by means of two Crank Handles incorporated in the chassis.

The front wheel axle is journalled in a 2½" Double Angle Strip that is pivoted loosely through its centre hole to a Double Bent Strip, which, in turn, is secured to the under surface of the Flanged Plate 15. Steering is effected from the 1½" Pulley 13 secured on a 3½" Rod that is passed through the 3½" × 2½" Flanged Plate 16, and held in position by Collars. To the lower end of the Rod a Bush Wheel 14 is secured, and this is connected to the Double Angle Strip carrying the front axle by cords tied to diametrically opposite holes in the Bush Wheel and to the ends of the Double Angle Strip.

The lower part of the escape is mounted pivotally on bolts 10 passed through the upturned ends of a 2½" × 1" Double Angle Strip that is bolted to a 3½" × ½" Double Angle Strip which, in turn, is supported on two vertical 2½" × ½" Double Angle Strips. The upper or moving portion of the escape slides between the 12½" Angle Girders 9 and is held freely in position by the nuts of the bolts 11.

Fig. 2 is a larger view of the ladder operating mechanism. The ladder is extended from the Crank Handle 2 that is journalled in a 2½" × ½" Double Angle Strip bolted to a 5½" Strip that, in turn, is bolted across the flanges of the Sector Plates. A Cord 7 is wound on to the Crank Handle and one of its ends is tied to a 2½" Strip that spans the inner end of the 12½" Strips forming the sides of the extending ladder. Its other end, 7a is then led towards the outer end of the fixed ladder, round a ½" loose Pulley held on a bolt in the centre hole of a 2½" Double Angle Strip that spans the outer end of the 12½" Girders 9, and finally is tied to the same 2½" Strip to which the end 7 is already attached. Thus by turning the Handle 2 the escape is pulled inward or outward.

The Crank Handle 1 controls the elevation of the ladder. It carries a ½" Pinion 3 that engages a 57-teeth Gear 4 secured to a Rod 12. A Cord 8 is wound a few turns round the Rod 12 and is then led to the 2½" Strip 5 where it is secured. By turning the Crank Handle the Cord is wound in, thus raising the pivoted escape. On turning the Handle in the opposite direction, the escape is lowered by its own weight.

In order to build this model the following parts will be required:—

4 of No. 1; 6 of No. 2; 3 of No. 3; 4 of No. 5; 8 of No. 8; 4 of No. 11; 1 of No. 12; 2 of No. 12a; 2 of No. 15; 2 of No. 15a; 2 of No. 16; 1 of No. 18a; 1 of No. 19; 1 of No. 19s; 4 of No. 19b; 3 of No. 20b; 1 of No. 21; 2 of No. 22; 1 of No. 23; 1 of No. 24; 1 of No. 26; 1 of No. 27a; 4 of No. 35; 87 of No. 37; 8 of No. 37a; 10 of No. 38; 2 of No. 40; 1 of No. 45; 1 of No. 46; 8 of No. 48a; 2 of No. 48b; 2 of No. 52; 2 of No. 53; 2 of No. 54; 4 of No. 59; 1 of No. 63; 2 of No. 90a; 2 of No. 99; 2 of No. 100; 4 of No. 111c; 2 of No. 126a; 4 of No. 142b; 1 of No. 162a; 1 of No. 162b; 1 of No. 165.

A Mechanical Knife Grinder

The knife grinder shown in Fig. 3 is a most realistic and amusing model. When the "grinding wheel" is rotated by means of the treadle, the Meccanitian oscillates backward and forward as if in the act of applying a tool to the grinding wheel !

The Meccanitian's body is a $2\frac{1}{2}$" Strip, which is bolted at its lower end to a $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip 1 and is held upright by a $\frac{1}{2}$" Reversed Angle Bracket 2 secured to the Double Angle Strip. Both the latter parts are free to turn about a $3\frac{1}{2}$" Axle Rod and the Double Angle Strip is connected pivotally with the treadle 3 by means of a $2\frac{1}{2}$" Strip.

The treadle, in turn, is connected pivotally with the crankshaft by two $2\frac{1}{2}$" Strips, each of the bolts 7 being secured by two nuts as in Standard Mechanisms No. 262. The Collar is mounted loosely on a $\frac{3}{4}$" Bolt secured rigidly to the Crank 5, and forms a Handle by means of which the model may be set in motion.

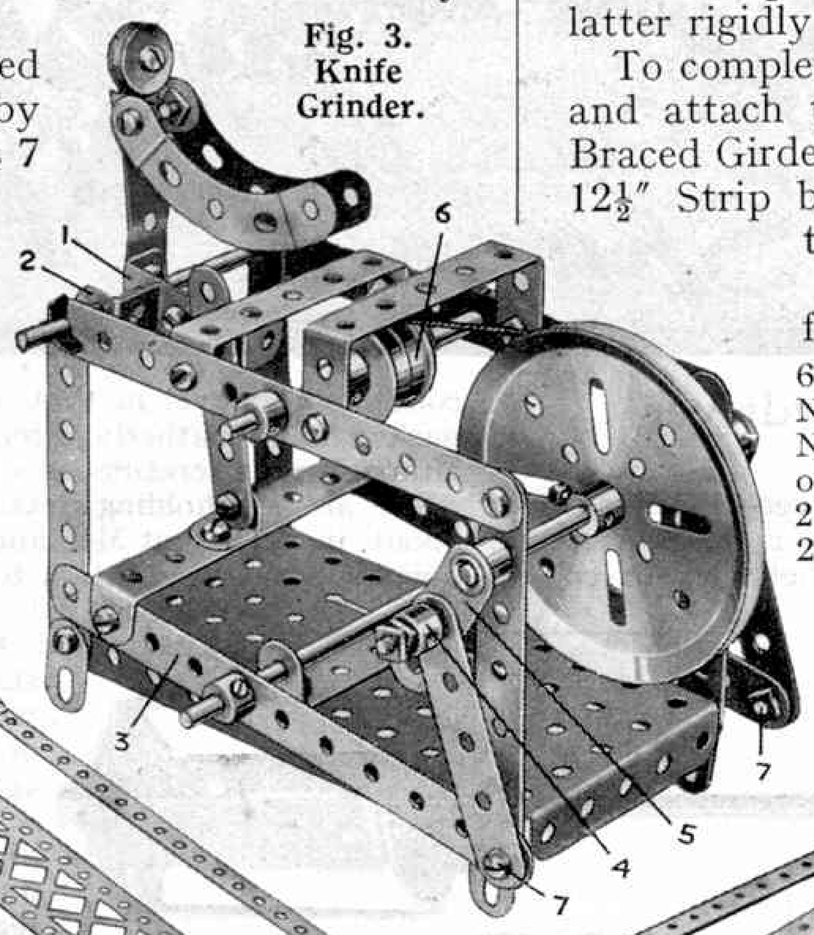


Fig. 3. Knife Grinder.

The Knife Grinder comprises the following parts:—
4 of No. 2; 4 of No. 3; 4 of No. 5; 4 of No. 10; 1 of No. 11; 1 of No. 12; 1 of No. 15a; 3 of No. 16; 1 of No. 19b; 2 of No. 20b; 1 of No. 23; 2 of No. 35; 27 of No. 37; 8 of No. 37a; 1 of No. 38; 1 of No. 46; 1 of No. 48; 2 of No. 48a; 1 of No. 48b; 1 of No. 52; 5 of No. 59; 2 of No. 62; 2 of No. 90a; 1 of No. 111; 1 of No. 125.

Single Engine Monoplane

The model shown in Fig. 4 is representative of a type of commercial aeroplane that has achieved considerable popularity both on the Continent and in America, but has not so far received much attention from British designers.

The fuselage of the machine consists of four $12\frac{1}{2}$" Angle Girders and two Sector Plates, the former being secured to the latter at the top by $2\frac{1}{2}$" Strips, and at the bottom by the undercarriage. The Girders are held the correct distance apart at the "tail" end by $1\frac{1}{2}$" Strips and the "tail" is brought to a neat point by means of four 3" Strips. The tail plane consists of two $5\frac{1}{2}$" Braced Girders, while the rudder is represented by four $2\frac{1}{2}$" Strips. The nose of the machine consists of two Flat Trunnions and a $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip to which is secured a Double Bent Strip thus forming a reinforced bearing for the propeller shaft. The propeller itself consists of a $5\frac{1}{2}$" Strip bolted to a Bush Wheel. The latter is mounted on a 2" Rod and is held in place, while free to rotate, by means of two $\frac{3}{4}$" Flanged Wheels secured to the ends of the Rod.

The undercarriage of the machine consists of two Trunnions bolted to Sector Plates which form the front part of the fuselage. To each of these Trunnions Cranks are bolted, their bosses forming bearings for a $3\frac{1}{2}$" Axle Rod on the ends of which the landing wheels (1" fast Pulleys) are secured. Two $2\frac{1}{2}$" Strips are also slipped on to the $3\frac{1}{2}$"Axle Rod and their upper ends are bolted to the $12\frac{1}{2}$" Girders of the fuselage, thus holding the latter rigidly to the "nose."

To complete the machine it is now necessary to build and attach the wings. Each wing consists of a $12\frac{1}{2}$" Braced Girder having a $5\frac{1}{2}$" Strip attached to each end, a $12\frac{1}{2}$" Strip being secured in turn between their ends, to form a complete wing unit.

In order to build the model Monoplane, the following parts will be required:—
6 of No. 1; 9 of No. 2; 1 of No. 3; 12 of No. 5; 2 of No. 6a; 4 of No. 8; 5 of No. 12; 1 of No. 15a; 1 of No. 17; 2 of No. 20b; 2 of No. 22; 1 of No. 24; 60 of No. 37; 4 of No. 37a; 1 of No. 45; 1 of No. 48; 2 of No. 48a; 2 of No. 54; 2 of No. 62; 2 of No. 99; 2 of No. 100; 4 of No. 111c; 2 of No. 126; 2 of No. 126a.

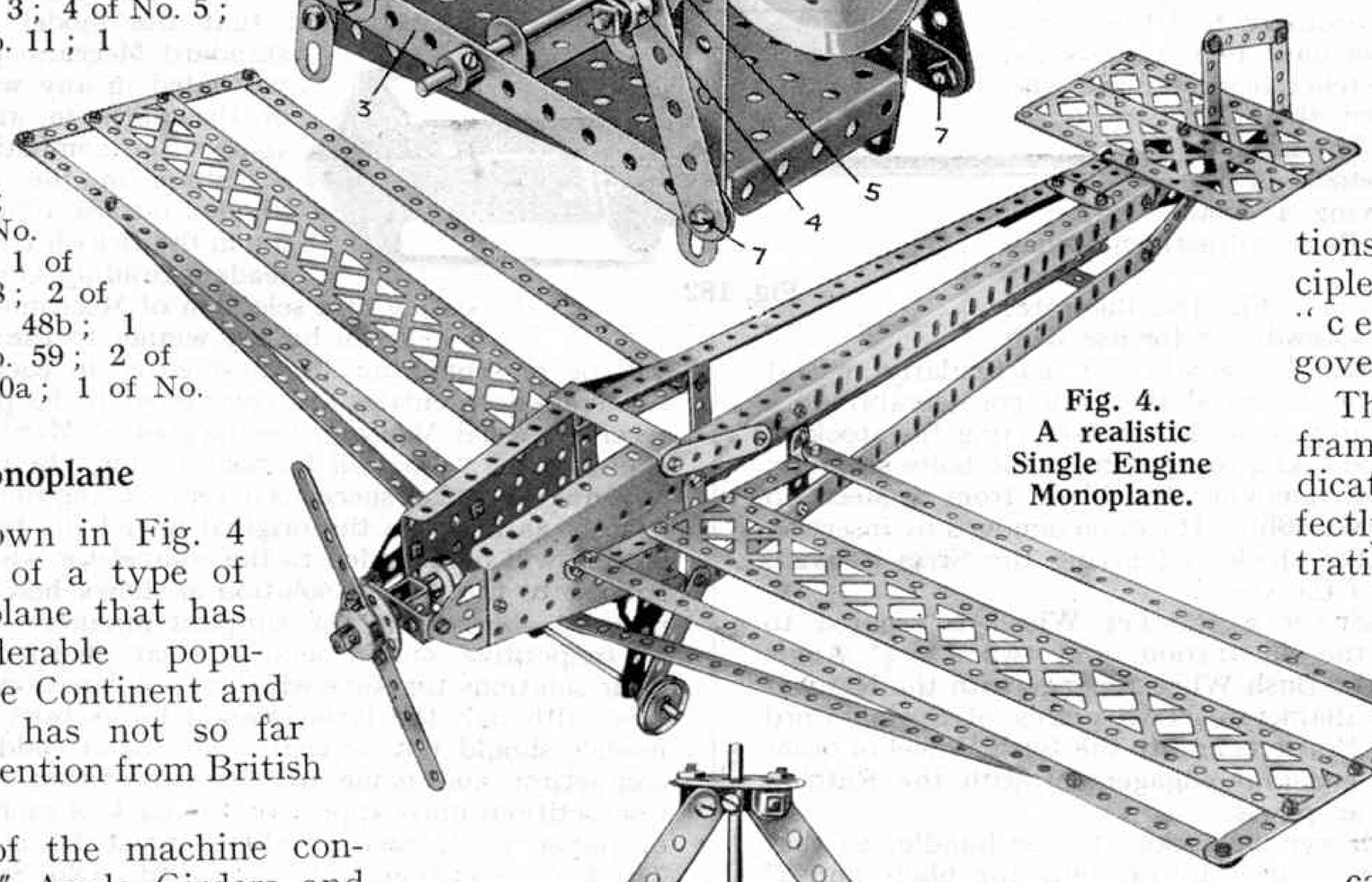


Fig. 4. A realistic Single Engine Monoplane.

Speed Indicator

In Fig. 5 is shown a model revolution indicator or "tachometer" which functions on a similar principle to the well known "centrifugal ball governor."

The construction of the framework holding the indicator mechanism, is perfectly clear from the illustration and the mechanism only will be described. A Crank fitted with a Threaded Pin to form a handle is secured on a $3\frac{1}{2}$" Rod carrying a 57-teeth Gear that meshes with a $\frac{1}{2}$" Pinion 1 on a $1\frac{1}{2}$" Rod. The latter Rod carries a Contrate Wheel and is journalled in one of the holes of a $5\frac{1}{2}$" Strip and a Double Bent Strip 2. A Pinion on the vertical 8" Rod which carries the governor is in engagement with the Contrate.

The $2\frac{1}{2}$" Strips forming the governor arms are lock-nutted to Angle Brackets which in turn are secured rigidly to Bush Wheels. The Bush Wheel 3 is free on the Rod but is secured to a $1\frac{1}{2}$" Pulley 4 by $\frac{3}{8}$" Bolts, and a $\frac{3}{4}$" Bolt 5 secured in a Coupling is slipped between the Bush Wheel and the Pulley. A Spring secured to the Bolt 6, returns the pointer 7 to zero when the governor shaft comes to rest.

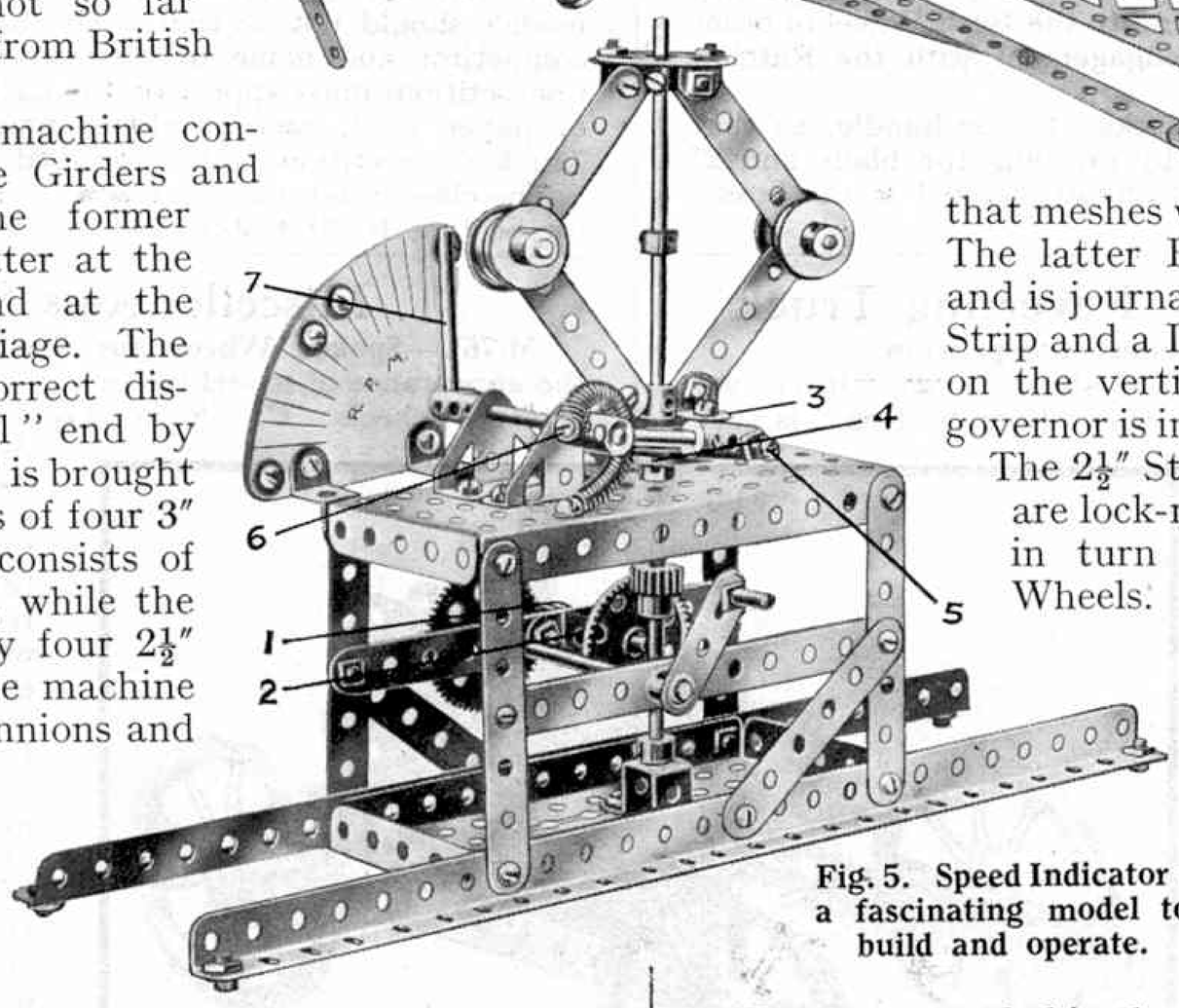
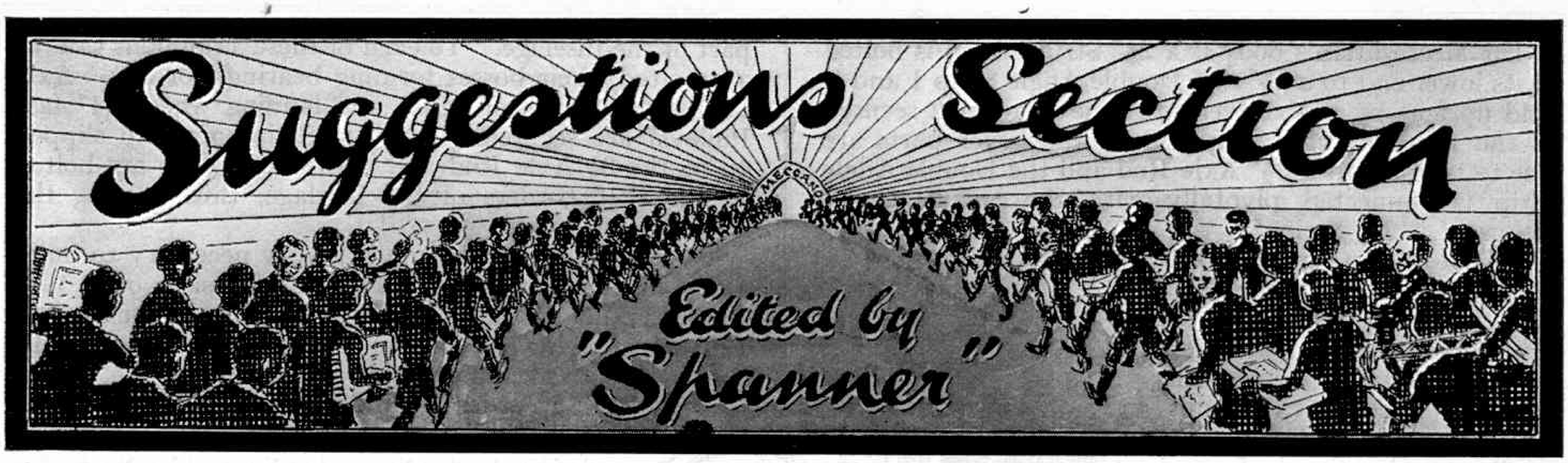


Fig. 5. Speed Indicator: a fascinating model to build and operate.

The parts needed in the construction of this model are:
2 of No. 2; 4 of No. 3; 2 of No. 4; 6 of No. 5; 2 of No. 8; 4 of No. 12; 1 of No. 13a; 1 of No. 16; 2 of No. 17; 4 of No. 18a; 4 of No. 20b; 1 of No. 21; 2 of No. 24; 2 of No. 26; 1 of No. 27a; 1 of No. 28; 39 of No. 37; 8 of No. 37a; 8 of No. 38; 1 of No. 43; 2 of No. 45; 2 of No. 52; 3 of No. 59; 1 of No. 62; 3 of No. 63; 2 of No. 90; 1 of No. 111; 2 of No. 111c; 1 of No. 115; 2 of No. 125; 2 of No. 126; small piece of cardboard.



(182)—A Useful Ratchet Screwdriver

(L. Simmons, Bromley, Kent)

A VERY useful development of the screwdriver—that tool which is all important to every Meccano boy—is the ratchet type. One of the chief advantages of a ratchet screwdriver is that a constant pressure may be exerted on the screw, whereas with the ordinary tool this is not the case. The latest types have two ratchets and a locking position, one ratchet being for use with right-handed screws whilst the other is for left-hand threads. The mechanism is fitted into the stock of the screwdriver, and by moving a small button any one of the three adjustments may be selected.

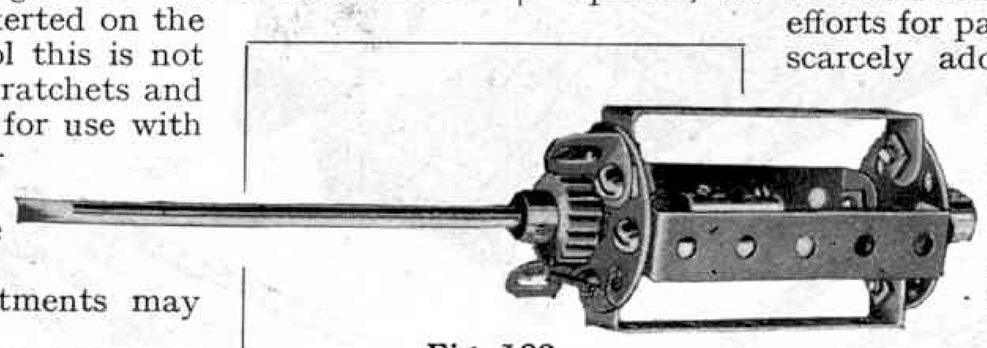


Fig. 182

The Meccano model shown in Fig. 182 illustrates a simple form of ratchet screwdriver for use with right-handed screws only. It should be particularly useful for model-building and should speed up work considerably.

No difficulty should be experienced in constructing the stock of the tool but care should be taken to tighten up the bolts securely. The blade is obtained by removing the blade from a Meccano Special Screwdriver (part No. 36b). It can be removed by inserting a Strip into the slot in the stock and giving the Strip a twist, so forcing the blade out of the stock.

In the built-up screwdriver a Ratchet Wheel is secured to the blade as shown in the illustration, and two $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets, lock-nutted to the Bush Wheel, engage with the Ratchet on opposite sides of its diameter. Two pieces of Spring Cord are attached to the Angle Brackets and to the Bush Wheel in order to keep the Brackets in constant engagement with the Ratchet Wheel, so that they act as pawls.

When desired the blade can be locked to the handle, so that nuts and bolts can be unscrewed, by gripping the blade and 2″ Rod attached to it by means of set-screws inserted in the bosses of the two Bush Wheels.

(183)—The Automatic Reversing Truck

Another Fascinating Mystery Competition

The popularity of the various "Mystery" competitions announced from time to time in the "Suggestions Section" is such that we make a practice of publishing similar contests whenever the opportunity occurs. An excellent example of a Mystery Model is afforded this month by the Automatic Reversing Truck suggested by A. Armstrong (Stone, Staffs.).

It will be seen from Fig. 183 that the model consists essentially of a framework built up from two $9\frac{1}{2}''$ Angle Girders connected at their ends by two $3\frac{1}{2}''$ Angle Girders. A Clockwork Motor is attached to one side of the frame and the whole is mounted on four 3″ Wheels.

The novel feature of the model is that it will continue to travel in the direction in which it is given its initial start. That is, if the Motor is wound up and the truck pushed in a northerly direction, it will continue to travel in that direction; on the other hand, if it is pushed in a southerly direction, it will travel in that direction, although no alteration or adjustment is made to the mechanism.

We are withholding details of the mechanism that brings this about, in order that Meccano boys may think out what is, in their opinion, the best solution to the problem, and then send in their efforts for participation in the competition. We need scarcely add that the model is constructed from standard Meccano parts, which are not mutilated in any way. Any mutilation of the parts in any entry will count against the competitor.

Entries in the competition will be divided into Section A, for readers residing in the British Isles, and Section B, for readers residing Overseas. A prize consisting of a selection of Meccano or Hornby goods, to be chosen by the winner to the value of one guinea, will be presented for the best entry in each section, and other readers whose entries are considered to be particularly good will receive special Meccano Certificates of Merit and complimentary copies of the "Book of Famous Trains," by C. J. Allen.

If no competitor succeeds in reproducing the operating mechanism exactly as fitted to the original model the principal prize in each section will be awarded to the competitor whose entry approaches nearest to the correct solution or shows how the required results may be obtained in the simplest manner.

Competitors should send in clear photographs or drawings of their solutions together with any explanations that may be necessary, although the latter should be as brief as possible. Actual models should not be sent. The name, address, and age of the competitor and name of the competition ("Reversing Truck" Competition) must appear on the back of each photograph or sheet of paper used, and envelopes must be addressed "Reversing Truck Competition," Meccano Ltd., Old Swan, Liverpool.

The closing dates are as follows: For Section A, 28th February; for Section B, 31st May, 1930.

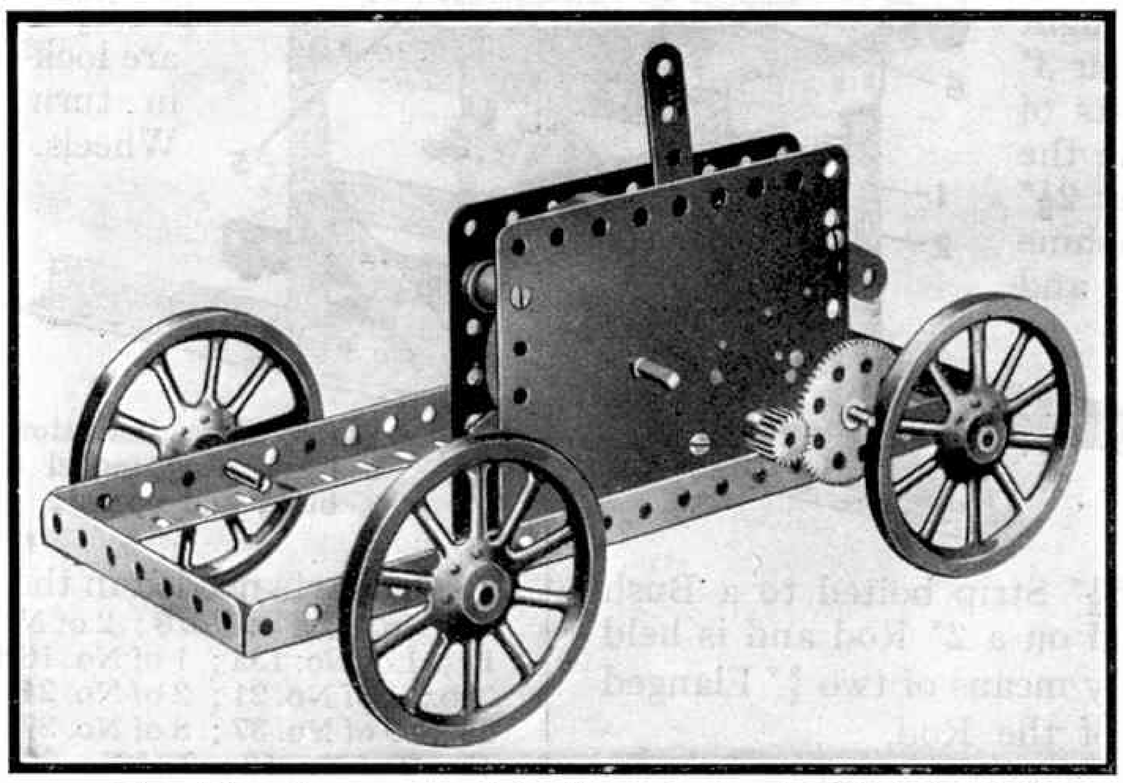


Fig. 183. Can you explain the movements of this truck?

Miscellaneous Suggestions

(M.76).—Spoked Wheels for Cars.—There is little doubt that the appearance of model motor cars is enhanced by the addition of artillery wheels. C. Glover (London, W.10) uses two Meccano Artillery Wheels (part No. 19a) secured a short distance apart on a Rod. A 3″ Dunlop Tyre may then be sprung into the groove between the two wheels, and the result is a single realistic road wheel, fit to grace the most elaborate car.

(M.77).—A Ukelele Capo.—For those Meccano boys who are musically inclined the following capo for use with a ukelele has been submitted by L. Hart (Benenden, Kent). It comprises a 2″ Meccano Rod and is held in the required position by means of a Spring (part No. 43) which passes round the back of the finger board, the loops of the Spring being passed over the ends of the Rod. Rubber tubing slipped on the Rod will protect the strings from injury.

Magic Clock Mystery Solved

List of Prize-winners

We are able this month to publish the list of prize-winners in the Magic Clock Contest, which was announced in the July, 1929, "*M.M.*" Readers may remember that in the competition announcement we included a front view only of the Mystery Clock (this illustration is reproduced at Fig. A), and the problem that Meccano boys were asked to solve was the means whereby the hand could be rotated and made to come to rest at any pre-determined hour. When we evolved this problem we thought it would prove a "teaser," but apparently we very much under-estimated the brain power of "*M.M.*" readers, for not only were solutions received corresponding with the official one, but a large number of really clever alternative ideas were also put forward.

Seven competitors sent in correct solutions (four in the Home Sections and three in the Overseas) and consequently we found it necessary to divide the First Prize in each section. Other boys whose ideas differed only slightly from the official solution and yet showed considerable ingenuity have been awarded consolation prizes. The ideas put forward by these readers, we may mention, were in each case a little more complicated than the correct solution.

Section A (Home) :—

FIRST PRIZE (Meccano products to value one guinea) divided equally amongst J. Rawlings, Seaford, Sussex; H. Greenberry, Putney, S.W.15; P. Short, Croydon; and G. Rhodes, Preston, Lancs.

TWELVE PRIZES, each consisting of a copy of "Famous Trains" by C. J. Allen: R. Newton, Clapham, E.5; C. Jenkins, Acton, W.3; M. Bird, Birmingham; W. Wilson, Clarkston, Renfrewshire; W. Kemsley, Folkestone; R. Holloway, Southampton; W. Gorton, Newport, Mon.; M. Hefford, Chiswick, W.4; R. Nash, Harrogate; F. Case, East Grinstead, Sussex; F. Butement, West Hampstead, N.W.6; T. Tasker, Barnsley.

Section B (Overseas) :—

FIRST PRIZE (Meccano products to value one guinea), divided amongst W. Smith, Fredericton, New Brunswick, Canada; J. Buckell, Montrea Canada; D. White, Dunedin, New Zealand.

TWELVE PRIZES, each consisting of a copy of "Famous Trains": S. Desai, Mota Falia, India; H. Potter, Sydney; A. Yoosufali, Colombo; G. Tuckey, Kaikohe, New Zealand; D. Young, Amaticulu, Zululand; R. Richards, Durban; J. Hetherington, Perth, Australia; M. D'Lima, Bombay; R. Ranikhetvala, Bombay; G. Tardrew, Johannesburg, S. Africa; W. Flanderka, Colombo; C. Hall, Toronto.

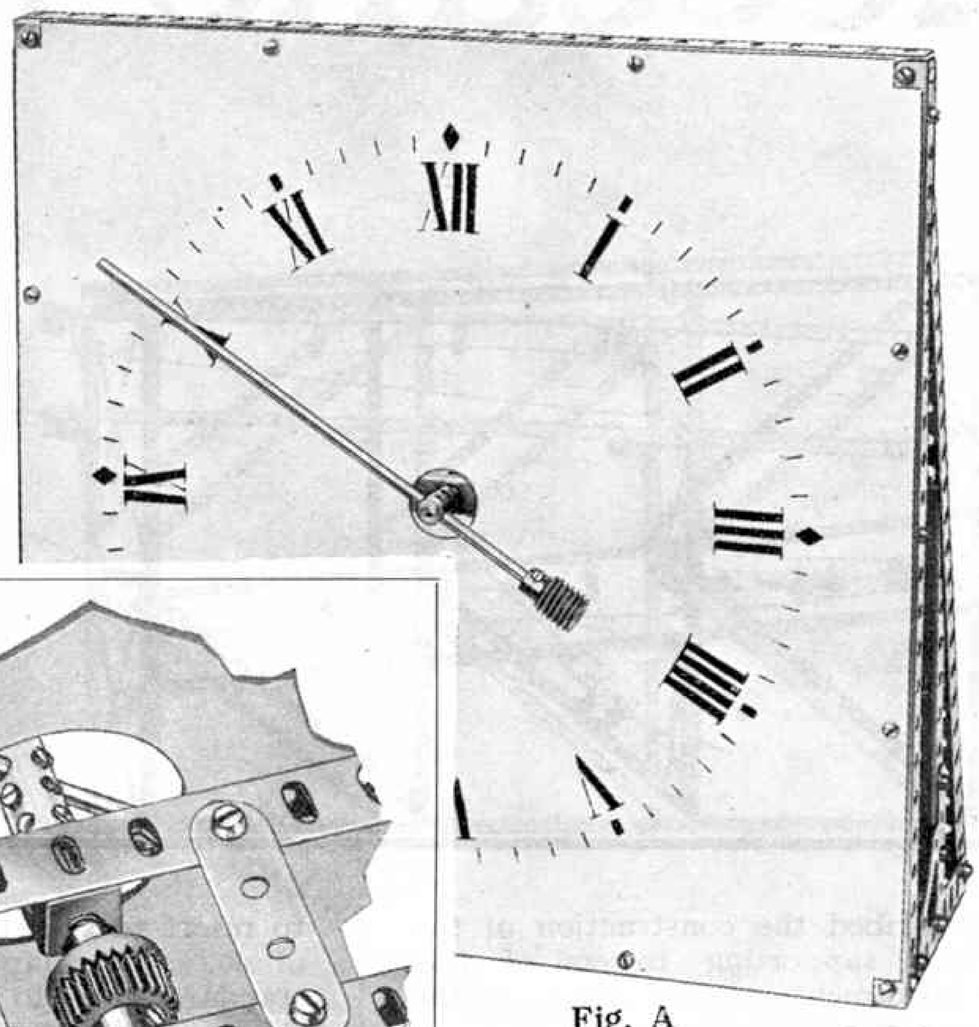


Fig. A

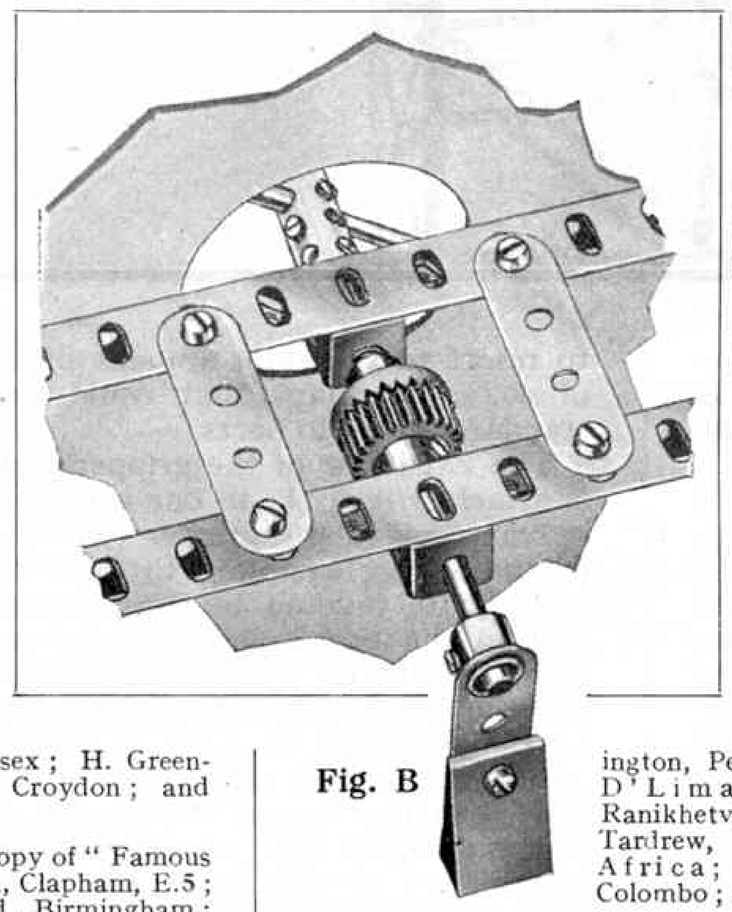


Fig. B

The mechanism is shown in Fig. B. A Compression Spring normally holds the Contrate Wheel in engagement with the Pinion on the weighted Rod. The operator draws the hand outward, thus releasing the clutch, and sets it at the specified time. He then re-engages the clutch and starts the hand spinning.

simple, and its general arrangement may be seen fairly clearly from the illustration. The Motors are bolted together in the manner shown and to each of their driving spindles a 1½" Contrate Wheel 1, 2, is secured. A Rod 4 carries two ½" Pinions which may be engaged with their respective Contrates on sliding the Rod by means of the lever 3. Of course it is important to see that only one Pinion at a time is in mesh with its Contrate.

The bearings for the Rod 4 are Couplings, one of which is mounted rigidly on the Motor side plate by a long bolt inserted in its end and gripped by a grub screw, whilst the other is secured on the end of a Rod that is gripped in a Double Arm Crank bolted to the rear plate of the right-hand Motor.

Two Handrail Supports secured to the right-hand Motor and a Trunnion on the left-hand one, form supports on which the device may be stood if it is desired to work in a horizontal position.

More Clockwork Motor Records

In the August, 1929, "Suggestions Section" we referred to the fact that a Clockwork Motor owned by J. A. W. (Northwood), had had six years' hard use and was still as good as new. The appearance of this paragraph brought upon our heads a perfect avalanche of letters claiming equally good or even better performances. The "endurance record," however, goes to Kenneth Brookes, of Leek, Staffs., and we cannot resist printing a paragraph of his letter.

> "My Clockwork Motor was bought at Christmas, 1910, and is therefore 19 years old. My elder brother used it then and it has since been handed on to me. It has been repaired once by Meccano Ltd., and has had one new Spring."

We imagine Brookes' Clockwork Motor must appear very different to the latest types, but it is evident that it is equally reliable.

Both K. Gaitskell (Battle) and R. Wright (Spennymoor) claim nine years' service for their Motors without once being repaired, whilst quite a score of Meccano boys report that their Motors have been in constant use for seven years or more. So J.A.W. can look forward to obtaining many more years of useful service from his Motor! Of course, the whole secret lies in keeping the Motors clean and well oiled.

Whilst on the subject of the Clockwork Motor, we may mention that we have received numerous letters from "*M.M.*" readers asking us to supply particulars regarding the power of the standard Motor. In response to these requests we recently carried out a test, and as we believe the results will be interesting and useful to many Meccano boys, we are appending them.

Weight Lifted	Height	Gear Ratio
36 lbs.	1 in.	49 : 1
25 lbs.	2½ ins.	49 : 1
18 lbs.	4 ins.	49 : 1
6½ lbs.	10 ins.	9 : 1
3 lbs.	20 ins.	3 : 1

Of course these figures are liable to considerable variation. It should be remembered that a Clockwork Motor exerts maximum power only after being well "run in."

(184)—Tandem Clockwork Motor Drive

(J. Garrett, Coulsdon, Surrey)

Although the Meccano Clockwork Motor forms an excellent power unit for most Meccano models, it suffers from a disadvantage in that it periodically runs down, thus necessitating a stoppage of the model that it is driving whilst the spring is rewound. Those Meccano boys who are fortunate enough to possess two Clockwork Motors, or who are willing to invest in a second one, may overcome this drawback by employing the simple and interesting device suggested by J. Garrett.

The necessary apparatus is shown in Fig. 184. The idea consists principally in arranging the two Motors in such a manner that either may be connected at will to the driving shaft. With this arrangement one Motor may be wound up while the other is working the model; hence there is always a wound Motor in reserve. When the first Motor is exhausted the other is brought into gear merely by moving a hand lever, and whilst it drives the model, the exhausted motor may be rewound.

The mechanism is

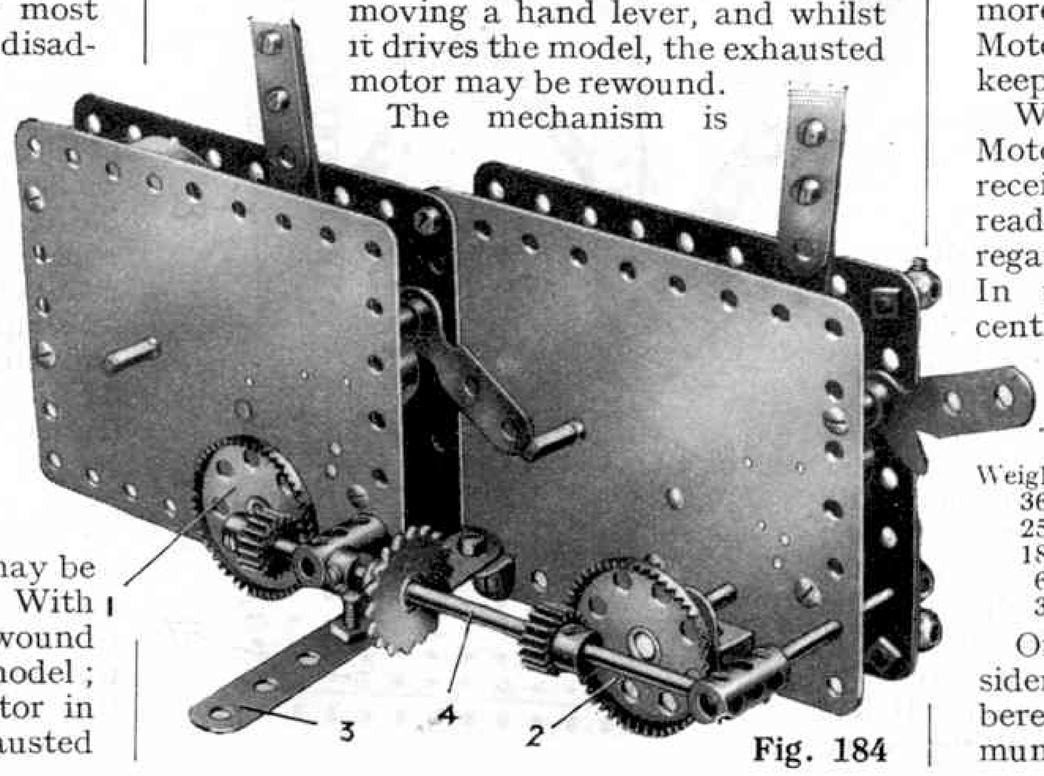
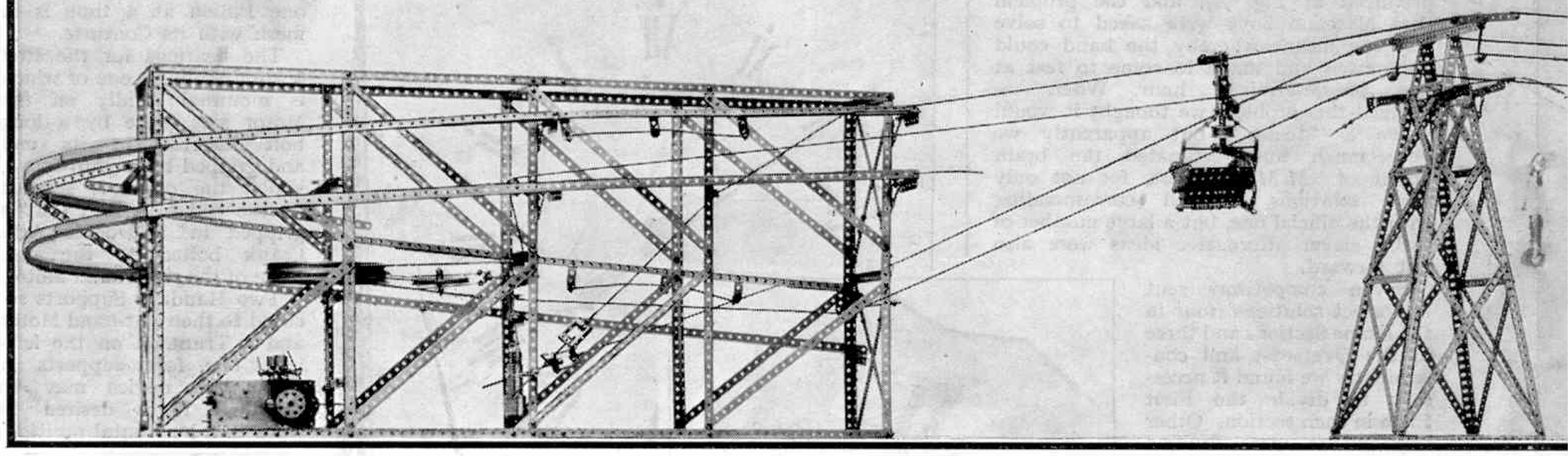


Fig. 184

A Meccano Aerial Rop



IN last month's "*M.M.*" we described the construction of the starting station, return, and supporting towers of this fascinating model. In this instalment we give details of the bucket, tipping gear, and the automatic loading plant.

The bucket is shown in Fig. 5. The bucket proper consists of two $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates, the ends of which are secured to $2\frac{1}{2}''$ Triangular Plates. A 2" Strip 15 and a 3" Curved Strip 16 are bolted to one end, so that the hinged Strip 17 may locate between the ends of the Strips 15 and 16, and thus maintain the bucket in a normally upright position. The bucket pivots freely on Pivot Bolts that are inserted in the lower holes of the containing frame 18 and secured to the bucket by double nuts. The catch 17 is attached pivotally to a Threaded Coupling 19 by means of a Pivot Bolt, inserted in the tapped bore of the Coupling.

The upper extremity of the containing frame consists of a pair of $4\frac{1}{2}''$ Strips, which are secured on each side of a Coupling by bolts, two Washers being placed on each of the bolts between the Strip and the Coupling for spacing purposes. A 5" Rod 25 is now pushed through the Coupling and through a Double Bracket at the bottom end of the $4\frac{1}{2}''$ Strips, and is secured in the transverse bore of the Threaded Coupling 19. Before finally securing the Rod in place, however, a Coupling and a Collar 26 should be placed on the Rod between the Double Bracket and the first Coupling. A Collar, two Flanged Wheels 20 (placed face to face), and three Washers, should also be mounted on that portion of the Rod between the Double Bracket and Threaded Coupling. The Flanged Wheels should, of course, turn quite easily.

On the second Coupling, which is free to slide on the Rod 25, a $\frac{1}{2}''$ loose Pulley 24 is mounted by means of a Pivot Bolt, which is locked by a nut in the transverse centre bore of the Coupling so that its shank does not touch the Rod. A Hand-rail Support is also secured to the Coupling on the opposite side. The runners consist of $\frac{1}{2}''$ fast Pulleys, mounted on Pivot Bolts, which are secured to opposite ends of a Double Arm Crank. The latter is attached pivotally to the fixed Coupling by means of a $\frac{3}{4}''$ Bolt, on which is placed a Collar between the boss of the Crank and the Coupling.

In the prototype the buckets are automatically disengaged from the hauling rope at the starting station, allowed to travel down the rails by gravity, and are re-attached to the hauling rope on the out-going side of the station. As this is an exclusive feature of a White ropeway, we went to much trouble to reproduce it in the model. It has been done quite successfully, but it was necessary to resort to a certain amount of filing in order to produce parts of a certain shape that could not be attained otherwise with standard Meccano parts.

The fixed jaw of the gripper is a Simple Bell Crank 21, which is attached securely to one side of the containing frame 18. The moving jaw of the gripper (which is operated by the movement of the sliding Coupling through the medium of the link 23) is a 2" Strip, pivoted to the Simple Bell Crank by a lock-nutted bolt in the first hole from one end, and connected to the link 23 at the other. The latter end also carries a 25-gramme Weight, and the upper end of the link 23 (a $1\frac{1}{2}''$ Strip) is attached pivotally to the Handrail Support mounted on the sliding Coupling.

It may be seen fairly clearly from the illustration that a slot is filed in the Simple Bell Crank, and the top corner of the end of the Crank is filed to an angle of 45 degrees. The end of the pivoted jaw is also filed to a shape broadly resembling a V, so that normally the hauling rope is jammed by the movable jaw into the corner of the slot in the fixed jaw. This action is augmented by the effect of the 25-gramme Weight at the end of the movable jaw. When the Pulley 23 is raised to its fullest extent there should be sufficient gap between the fixed and moving jaws of the gripper to permit of the hauling rope being freed. The jaws should be carefully filed with this end in view, care being taken at the same time, however, to ensure that, when closed, the rope is gripped tightly. As the jaws are separated by the thickness of the locknut of the fulcrum bolt from each other, it will be found necessary to bend the ends of the jaws closer together so that they may function efficiently. It is necessary to take some pains over the gripper, but the builder will be well repaid by the reliable working of the model.

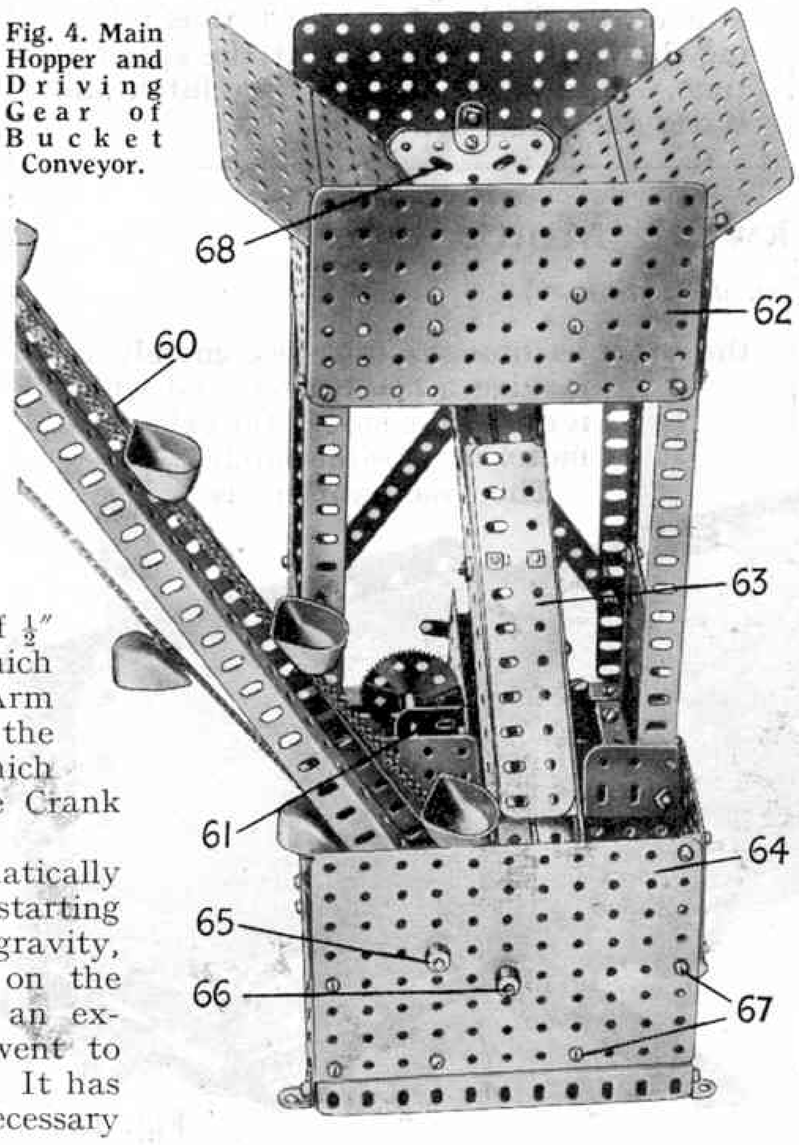
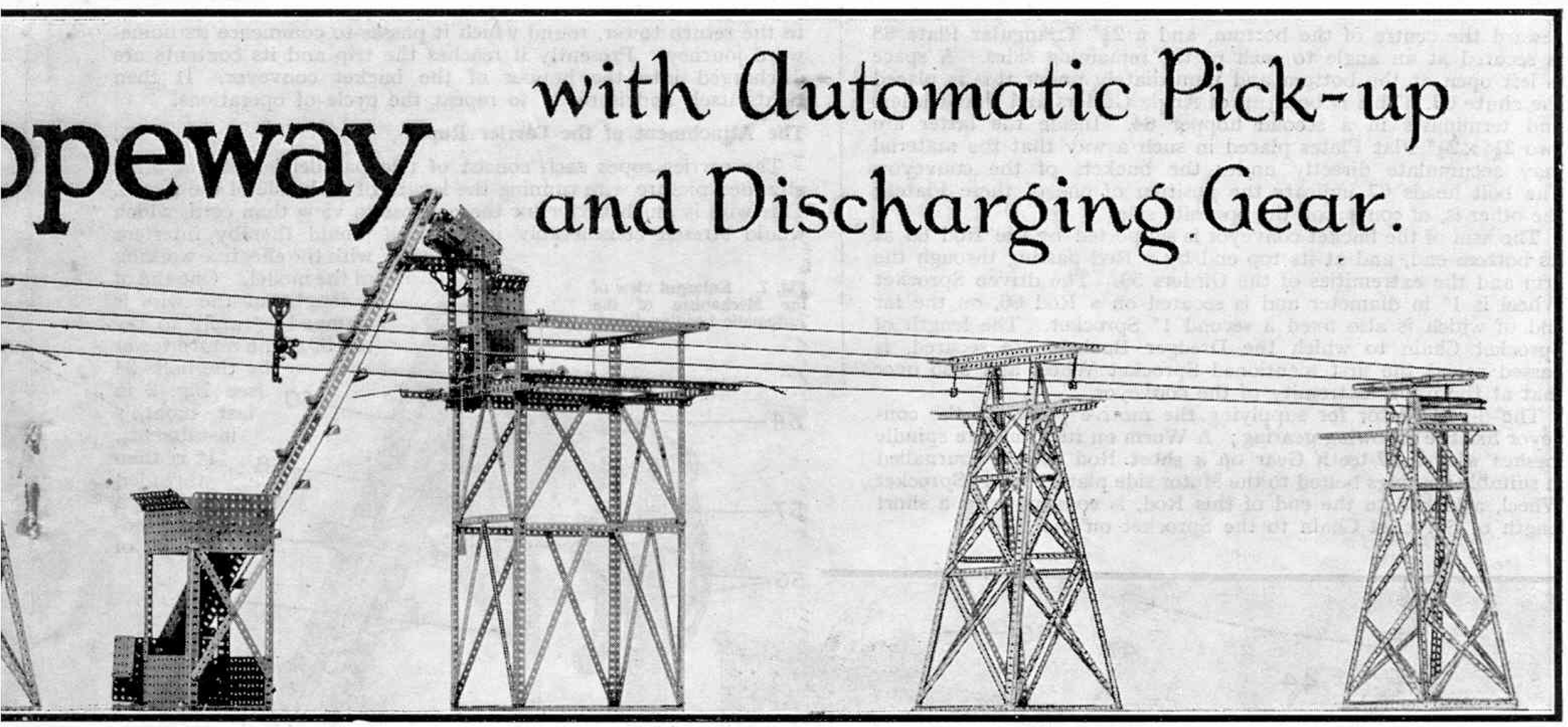


Fig. 4. Main Hopper and Driving Gear of Bucket Conveyor.

The trip (Fig. 6) consists of a $4\frac{1}{2}''$ Strip, on either side of which are bolted Flat Trunnions, which are clamped to the carrier rope. A 1" loose Pulley is free to turn on a Pivot Bolt 35, on which are lock-nutted a Simple Bell Crank 36 and a $1\frac{1}{2}''$ Strip carrying a weight in the shape of a Collar 37. A guide 38 serves to maintain the device in correct relationship with the bucket by pressing against the bucket guide roller 20. The object of the Crank 36 is to prevent the hauling rope being pulled off the Pulley; the gripper of the bucket, in travelling to the left, strikes the furthest arm of the Crank and raises the one over which it has already passed, thus always keeping the hauling rope in place. The Crank is returned to its normal



position by the weight of the Collar 39.

In the prototype the tipper may be placed anywhere on the system, with the result that the dumping ground may be shifted from time to time, but in the model its position has been fixed to enable the bucket to discharge its contents into the hopper of the automatic loading station, so that the operation of the model may be continued for any desired length of time. The discharge of the contents of the bucket is affected by the Buffer 39 on the bottom extremity of the $4\frac{1}{2}''$ Strip of the trip, engaging with a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket on the catch 17 of the bucket. The catch is raised thereby, and since the bucket proper is in a state of unstable equilibrium, it cants sideways and discharges its contents. It is returned by the balance weights 28.

The Automatic Loading Plant

The automatic loading plant is perhaps one of the most interesting features of the model, for it is here that the material is discharged by a bucket conveyor into a hopper, which is in turn, discharged into the bucket of the ropeway. These operations are accomplished automatically without stopping or handling the bucket on the ropeway in any way, just as in the original apparatus—another patent feature of a White Ropeway.

By glancing at the general view of the model a fair idea of the chief constructional features of this portion of the apparatus may be obtained, but in order to get a better idea of the working details, it is necessary to refer to Figs. 4 and 7. We will take first Fig. 7. The bucket runs along the rails 44 (to which the carrier rope is clamped) and its guide roller 20 bears against the guide rail 43. Each of the rails 44 are attached by $1'' \times \frac{1}{2}''$ Angle Brackets to the ends of $12\frac{1}{2}''$ Angle Girders 41 spanning the tops of the Girders 40. $\frac{3}{8}''$ Bolts serve to secure the rails to the $1'' \times \frac{1}{2}''$ Angle Brackets, two Washers and a Flat Bracket being placed on each bolt. The Washers serve to space the rail from the Angle Bracket and the Flat Bracket is for the purpose of clamping the carrier rope in position.

Each of the guard rails 43 is secured to girders 42 in the manner shown. Each of the girders 42 consists of two $7\frac{1}{2}''$ Angle Girders overlapped two holes and care must be taken to see that the guard and running rails are the correct distance apart, so that the bucket may run easily.

The movable hopper 46 should be constructed next. This is built up with $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates for the sides, back, and the sloping bottom, and with two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates for the front, the lower one (49) of which is secured by a Hinge to the upper one, so that it may open outward. The sloping floor is a $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate, as mentioned above, and is secured in place by $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets, so that its rear edge is situated $1''$ below the top edge of the back plate. It is set at such an angle that its front portion coincides with the front bottom corners of the side plates, and from there it is prolonged by a Sector Plate to form a chute, a second Sector Plate being placed over the first to keep the material from spilling. Two $2\frac{1}{2}'' \times 1''$ Angle Strips are secured across the bottom of the hopper, short arms downward, and these in turn, are bolted to two parallel $5\frac{1}{2}''$ Angle Girders. In the latter are journalled axles carrying $1''$ fast Pulleys, which run on rails 45.

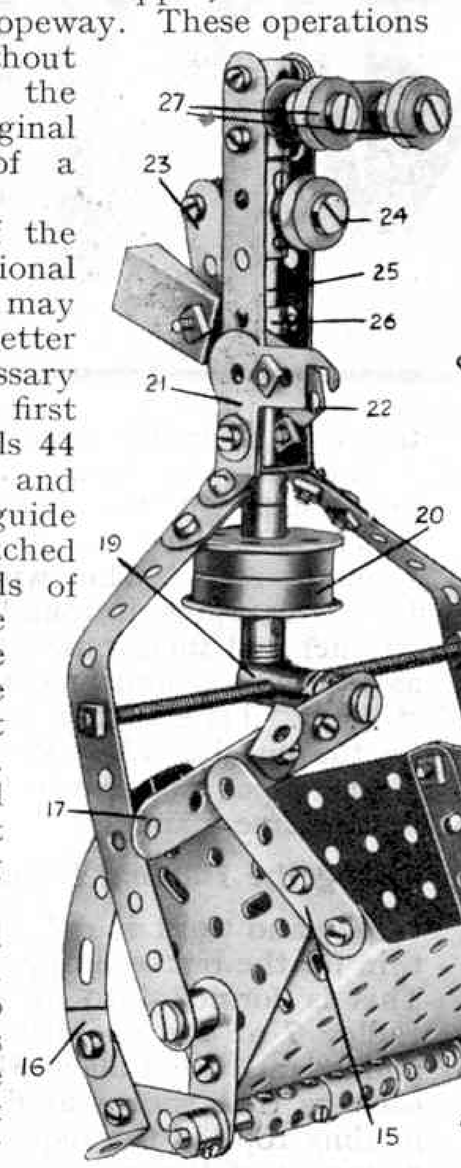


Fig. 5.
The Bucket, showing Gripper and Catch.

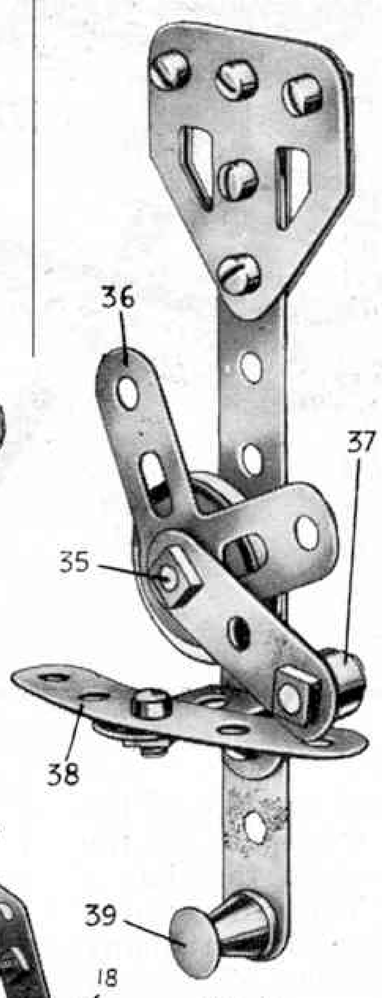


Fig. 6.
The Trip.

The tilting hopper 54, into which the bucket conveyor 60 discharges its contents, is composed of two Sector Plates, which are bolted to a $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate, two $3\frac{1}{2}''$ Strips spacing each Sector Plate away from the Flat Plates, in order to give room for the hinged trap 57. The hopper is mounted freely on lock-nutted bolts that are journalled in the top holes of the $9\frac{1}{2}''$ Angle Girders 55, and 25-gramme Weights keep it normally in the position shown in the illustration.

Normally also the Weight 52 keeps the movable hopper to the right. Hence its edge bears against the $3''$ Curved Strips 56 and keeps the hopper 55 tilted, so that the contents of the latter may slide into it. The trap 49 is kept closed by a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 48.

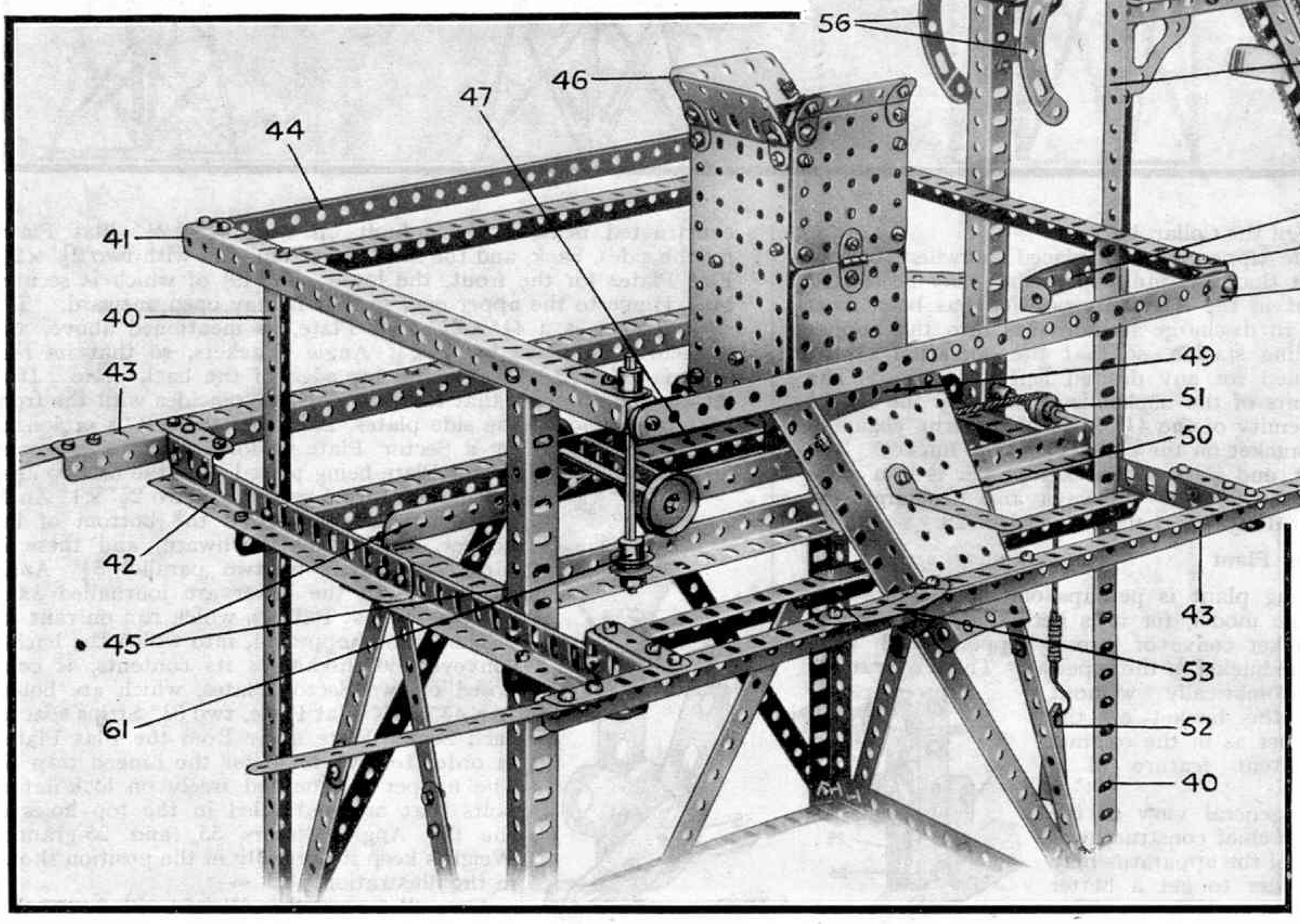
Now when the bucket reaches this portion of the apparatus (moving of course from right to left), it strikes the arm 50, which is secured rigidly to the movable hopper, and drags the latter along with it. As the hopper commences to move, the tilting hopper falls to a horizontal position, thus preventing any egress of the material, and the trap 49, freed from the Double Angle Strip 48, opens. This allows the bucket to fill. When the guide roller of the bucket reaches the ramp 53, the bucket is swung out of contact with the Strip 50. The hopper, thus freed, moves back under the influence of the Weight 52 and strikes the curved Strips, thereby allowing the accumulated contents of the tilting hopper to be shot into it.

The bottom end of the bucket conveyor is shown in Fig. 4, from which it may be gathered that the hopper into which the buckets discharge is simply constructed from Flat Plates 62. Two of its sides slope downward

toward the centre of the bottom, and a 2½″ Triangular Plate 68 is secured at an angle to each of the remaining sides. A space is left open at the bottom and immediately under this is placed the chute 63. This is built up of Angle Girders and Flat Girders and terminates in a second hopper 64. Inside the latter are two 2½″ × 2½″ Flat Plates placed in such a way that the material may accumulate directly under the buckets of the conveyor. The bolt heads 67 indicate the position of one of these Plates; the other is, of course, on the opposite side.

The arm of the bucket conveyor is supported by the Rod 65 at its bottom end, and at its top end by a Rod passing through the arm and the extremities of the Girders 59. The driven Sprocket Wheel is 1″ in diameter and is secured on a Rod 66, on the far end of which is also fixed a second 1″ Sprocket. The length of Sprocket Chain to which the Dredger Buckets are secured, is passed round the first mentioned Sprocket Wheel and also over that at the upper extremity of the conveyor.

The 6-volt Motor for supplying the motive power to the conveyor has the following gearing; A Worm on its armature spindle meshes with a 57-teeth Gear on a short Rod that is journalled in suitable bearings bolted to the Motor side plates. A 1″ Sprocket Wheel, attached to the end of this Rod, is connected by a short length of Sprocket Chain to the Sprocket on the Rod 66.



Completing the Model

As the various units are now complete, the final erection of the model may be proceeded with. First of all, the space at the disposal of the builder should be considered, since this has a bearing on the total length of the installation. The arrangement shown in the general view is 15 ft. long approximately, but many readers may prefer to make their model much longer. This may easily be done by adding more supporting towers, preferably between the automatic loading plant and the return tower. The various units should be screwed down by ordinary wood screws to a base (a long plank will do excellently) and the attachment of the carrier rope proceeded with.

It will be assumed for the purpose of making matters as clear as possible that the model is erected exactly as shown in the general view. That is, each unit is screwed down firmly by ordinary wood screws to a long plank in the order shown. The bucket should be assumed to be moving to the left from the position shown in the illustration. When it reaches the operating station it is dis-engaged from, and re-engaged with, the hauling rope in the manner described previously. It is then hauled up the steep slope of the out-going carrier rope, passed through the automatic loading plant, and along the entire length of the model to the return tower, round which it passes to commence its homeward journey. Presently it reaches the trip and its contents are discharged into the hopper of the bucket conveyor. It then rights itself and is ready to repeat the cycle of operations.

The Attachment of the Carrier Rope

The carrier ropes each consist of two parallel lengths of brass stranded picture wire running the length of each side of the model. This wire is much better for the purpose in view than cord, which would stretch considerably in use and would thereby interfere with the effective working of the model. One end of a length of the wire is clamped securely to the rail 30 of the return tower by the bolts 34 (see Fig. 2 in last month's instalment). It is then threaded through the saddle of the first supporting tower in the manner described last month. That is, it is passed over the top of the Washer on the first bolt, under the second, and over the third. The wire is then clamped to the inside of the rail 44 (Fig. 7) by the Flat Brackets on the rail retaining bolts, and is passed through the saddle of the second supporting tower in a similar manner to that adopted in the first.

Fig. 7. Enlarged view of the Mechanism of the Automatic Loading Plant.

The wire is then guided through the space between the underneath of the running rail 1 (Fig. 3) and a 3″ Girder, which is secured by its slotted holes to the underside of the running rail. The wire is secured finally to the strainer 12 by wrapping it round the ½″ loose Pulley on the end of the strainer and then round itself. This should be done very securely as the wire is under considerable tension when tightened by the strainer. (The carrier rope may be identified in the illustration by the number 13). We have only considered the fitting of one carrier rope; the one on the other side of the installation is treated in the same manner.

Fitting the Hauling Rope

Meccano Cord is not used for the hauling rope, since it is too thin for the bucket gripper to hold, but is replaced by thick string. This is formed into an endless belt passing round the driving Pulley 7 at the operating station, along each side of the model, and round the Pulley 31 on the return tower. Guide Pulleys, such as that shown at 61 in Fig. 7, are employed to retain the hauling rope in the required position on the various towers. The distances of the guides from the carrier rope should be carefully adjusted with the bucket in position, (*Continued on page 162*)

February Model-Building Competition

Ninety Splendid Prizes to be Won

CHEQUES, BOOKS AND MECCANO GOODS

THIS contest has been organised specially so that Meccano boys and girls of all ages and with all sizes of Outfits may be given an equal chance of winning one of the 93 valuable prizes listed in the panel on this page. No matter how small or apparently insignificant your model may be we want you to enter it in this contest, because very often the smallest models prove the most interesting and carry off the largest prizes.

Do not think that you are not suited, or have insufficient experience, to compete in a model-building contest. The simple act of building Meccano models from an Instruction Manual affords all the experience that is necessary to put you well on the road to success in these contests. Simply give your imaginative powers full rein and put forward your best creative effort.

Any number of parts may be used, and any type of model is suitable. There are no entrance forms to fill in and no fees to pay. The only condition stipulated is that models must be the competitor's own unaided work, both in regard to design and construction.

In sending in an entry try to think of something original, or something that has not hitherto appeared in the Meccano publications, then set to work and make a neat model of it in Meccano.

Do not send actual model. Simply take a photograph of it or make a good drawing. Then if these are not very clear, write a short explanation and post to "February" Model-building Contest, Meccano Ltd., Old Swan, Liverpool.

There will be three Sections: Section A, for readers over 14 residing in the British Isles; Section B, for readers under 14 years of age residing in the British Isles; Section C, for readers of all ages residing Overseas.

Closing dates: Sections A and B, 31st March. Section C, 30th June, 1930.

THE PRIZES

The Prizes to be awarded in Sections A and C are as follows:—

First Prize: Cheque to value £3-3s.
Second Prize: Cheque to value £2-2s.
Third Prize: Cheque to value £1-1s.
Six Prizes, each consisting of Meccano products to value 10/6.
Six Prizes, each consisting of Meccano products to value 5/–.
Six Prizes, each consisting of a copy of "Famous Trains."
Twelve Prizes, each consisting of a Meccano Engineers' Pocket Book.

The Prizes in Section B are as follows:—

First Prize: Meccano products to value £2-2s.
Second Prize: Meccano products to value £1-1s.
Third Prize: Meccano products to value 10/6.
Twelve Prizes, each consisting of Meccano products to value 5/–.
Twelve Prizes, each consisting of a "Meccano Engineers' Pocket Book."

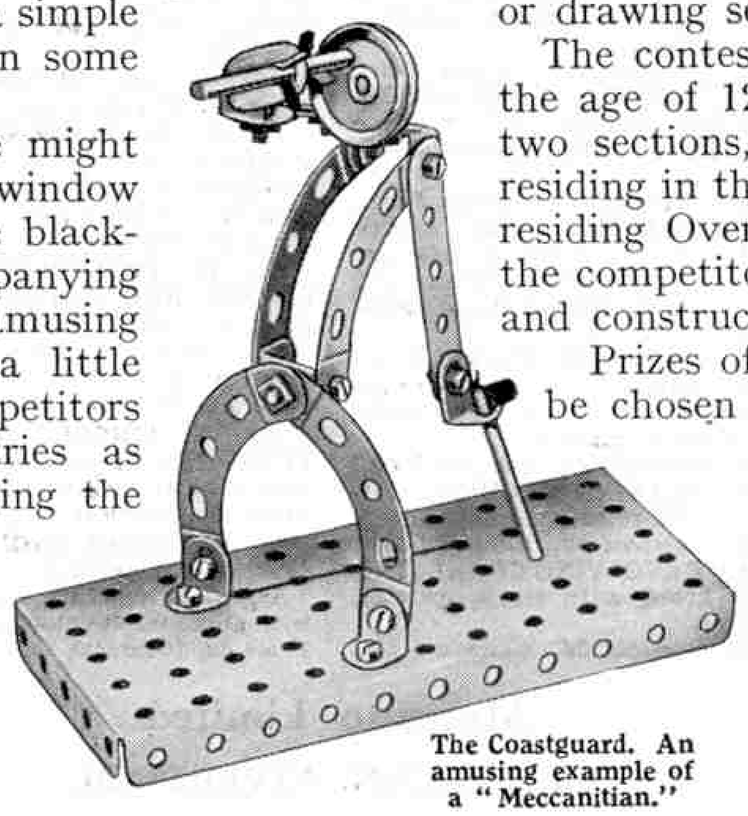
A limited number of Certificates of Merit will be awarded in each Section.

A NOVEL "MECCANITIAN" COMPETITION

In this simple competition, which is organised more especially for the benefit of the younger Meccano boys and girls, a number of fine prizes are offered for the most humorous model of a "Meccano man!" To compete in the contest it is only necessary to build a simple little model depicting a man engaged in some everyday task.

As examples of what is required we might mention a policeman directing traffic, a window cleaner busy on his ladder, or a village blacksmith at work at his anvil. The accompanying illustration of a Coastguard is a further amusing example of what can be done with a little ingenuity and very few parts! Competitors should endeavour to make their entries as humorous as possible; the more amusing the effect, the greater the chance of winning a prize. Any number of parts may be used in constructing the model, but simplicity and humour will count most when judging.

When the model is built it is only necessary to make a drawing, or better still, take a photograph of it and send it in an envelope addressed to "Meccanitian" Contest, Meccano Ltd., Old Swan, Liverpool. Competitors must write their age, name and address on the back of each photograph or drawing sent.



The Coastguard. An amusing example of a "Meccanitian."

The contest is open to all boys and girls under the age of 12 years. Entries will be divided into two sections, as follows. Section A, for readers residing in the British Isles; Section B, for readers residing Overseas. Any model submitted must be the competitor's own unaided work, both in design and construction.

Prizes of Meccano or Hornby Train goods (to be chosen from our catalogues by the winners themselves) to the value of 15/–, 10/– and 5/– respectively will be awarded in each section to the senders of the most cleverly constructed and amusing models in order of merit. In addition there will be a number of consolation prizes.

Closing dates: for Section A, 28th February; Section B, 31st May, 1930.

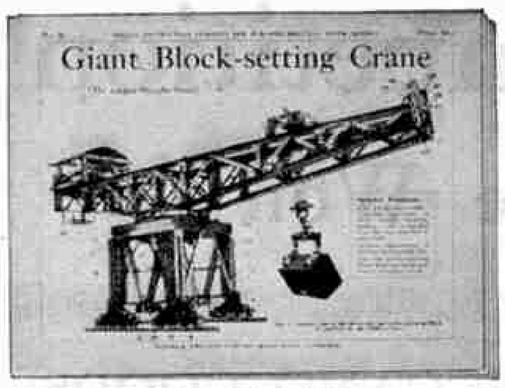
MECCANO

SUPER MODELS

Our expert designers have produced for us 35 super models that reach the highest pinnacle ever attained in Meccano construction. Each model in this series is a masterpiece and there is not a boy who will not be eager to build them all.

These models are so important that we have engaged expert engineers to describe them and a special leaflet with beautiful half-tone illustrations has been written for each of them. A selection of the leaflets is illustrated on this page.

A brief description of each model in the series is given below and the number and price of the special Instruction Leaflet are indicated. Copies of the leaflets may be obtained from any Meccano dealer or direct from us, post free, at the prices shown.



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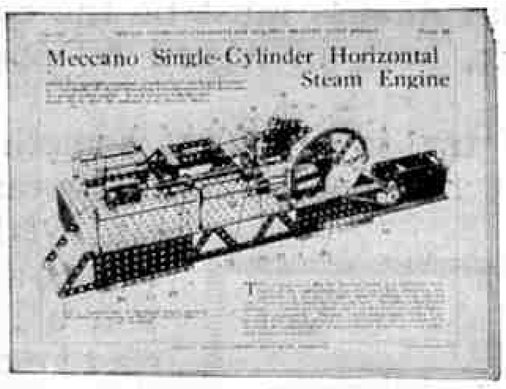

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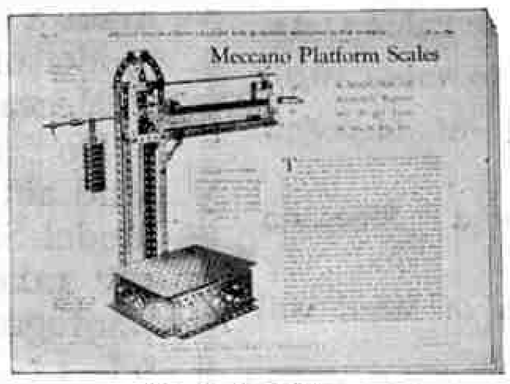

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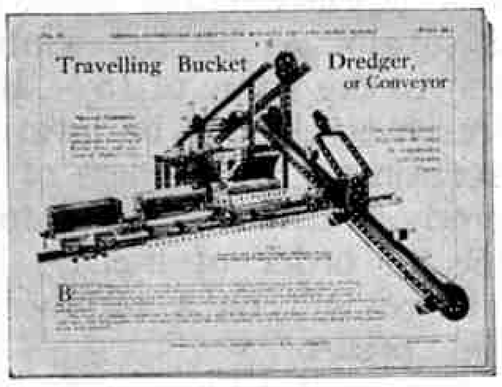

No. 5 Leaflet.

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No. 2 SHIP COALER. All the movements of a real ship-coaler are reproduced in this model. *Price 3d. (Overseas 4d., Canada 8 cts.)*

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No. 19 STEAM SHOVEL. This model embodies travelling, rotating, racking and digging movements, and jib hoisting and lowering gear. *Price 2d. (Overseas 3d., Canada 5 cts.)*

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No. 28 PONTOON CRANE. The movements of this model include the operation of the two hoisting blocks, slewing of the entire crane, and luffing. *Price 2d. (Overseas 3d., Canada 5 cts.)*

No. 29 HAMMERHEAD CRANE. This is a very realistic and powerful model, comprising traversing, hoisting and slewing motions. *Price 2d. (Overseas 3d., Canada 5 cts.)*

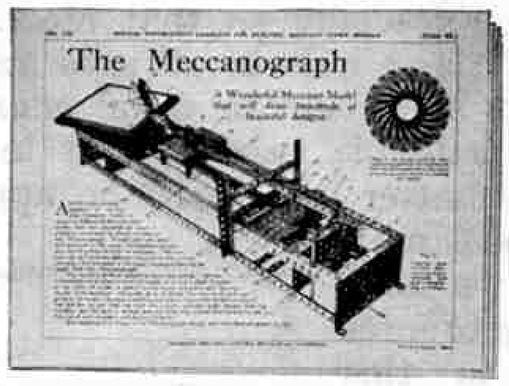
No. 30 BREAKDOWN CRANE. This model is equipped with travelling, slewing, luffing, and hoisting motions, and also is fitted with laminated springs, brakes, out-riggers, etc. *Price 3d. (Overseas 4d., Canada 8 cts.)*

No. 31 WAREHOUSE WITH ELEVATORS. The two cages are driven automatically and work alternately, pausing at top and bottom positions. *Price 3d. (Overseas 4d., Canada 8 cts.)*

No. 32 TWO-CYLINDER STEAM ENGINE AND BOILER. This is a realistic working model of a complete steam plant, equipped with valve gear, governor, balanced cranks, etc. *Price 3d. (Overseas 4d., Canada 8 cts.)*

No. 33 SINGLE AND DOUBLE FLYBOATS. These two models represent popular pleasure-fair attractions. *Price 3d. (Overseas 4d., Canada 8 cts.)*

No. 34 THREE-ENGINE BIPLANE. This is a realistic model of an "Argosy" machine, and is fitted with ailerons, elevators and rudders. *Price 3d. (Overseas 4d., Canada 8 cts.)*



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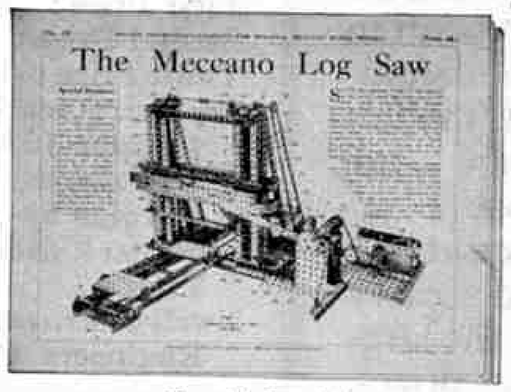

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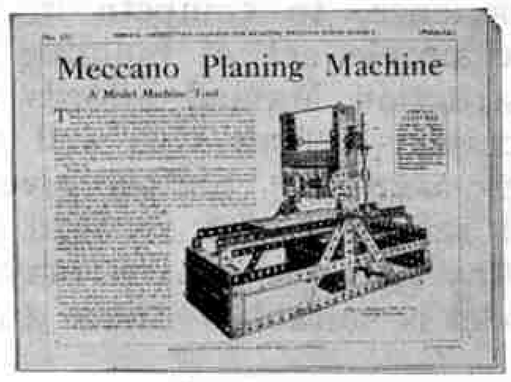


No. 17 Leaflet.

No. 6 Leaflet.

No. 19 Leaflet.

Meccano Limited

OLD SWAN, LIVERPOOL

The Meccano Harmonograph

Fascinating Designs From Pendulum Movement

AMONG the great number of splendid models that have been built with Meccano, two stand in a class by themselves—the Meccanograph and the Harmonograph. These two models are unique in that they provide means for producing an almost endless variety of beautiful designs without the necessity for artistic skill on the part of the operator.

Although both these models are design-producers, they each have a strongly-marked individuality, not only in the nature of the designs, but also in the manner in which they are produced. With the Meccanograph thousands of totally different designs may be made and any given design may be duplicated if desired; but in every case the finished work is mechanically produced. With the Harmonograph, on the other hand, the designs are produced by purely natural means; that is to say, by the rhythmic movements described by a pendulum as it swings in obedience to the law of gravity.

For this reason many Meccano enthusiasts prefer the Harmonograph. There is certainly no doubt about the fascination of watching this model set to work, and of speculating as to the nature of the design it will produce. All these designs, of course, are produced in permanent form, and it is exceedingly interesting to make a collection of them.

The special Instruction Leaflet No. 26 describes the construction of the Harmonograph in such a detailed manner that no difficulty will be experienced at any stage; and the operation of the model is as simple as its construction. All that is necessary is to pin a sheet of white paper to the table of the model, fill the pen with ink, and then set the pendulum rod and weights swinging. The Leaflet gives instructions for making the glass pen that has been specially designed for use with the model. A really satisfactory pen is essential to the successful production of clean designs, and the one described represents the results of many experiments carried out with the object of producing a pen that is not only perfect in operation, but also—what is equally important—extremely simple to make.

The nature of the ink used has an important bearing upon the results. After a long series of experiments we found that the cleanest designs were produced by using the best quality of draughtsman's black ink. Violet drawing ink is also to be recommended, and if of good quality is quite satisfactory. Ordinary Indian ink should not be used as it is too thick for the purpose.

The paper used should be of good quality, having a perfectly even surface. Rough-surfaced paper is not at all satisfactory and should be avoided; and paper with a highly-finished "art" surface is generally too absorbent for the production of designs of the best quality. It has been found that excellent results are obtained on Bristol board.

The designs produced by the Harmonograph may be varied almost indefinitely by altering, either together or separately, the mass of the weights of the primary and secondary pendulums embodied in the model. For example, the effect may be tried of using a heavy weight on the end of the secondary pendulum and a light one on the primary. Then this order of weights may be reversed, and in this manner an entirely new set of designs will be produced. Further variations may be obtained by altering the positions of the weights on their respective rods.

Although no skill is required to produce the designs, a certain amount of care must be taken in manipulating the model, rough treatment, in particular, being fatal to success. When all is ready to commence operations the pen should be lowered carefully on to the paper by supporting in the hand the balance weight attached by cord to the pen arm, and which normally holds the pen clear of the table. When the design is completed the pen is lifted clear again by withdrawing the support of the hand from beneath the weight.

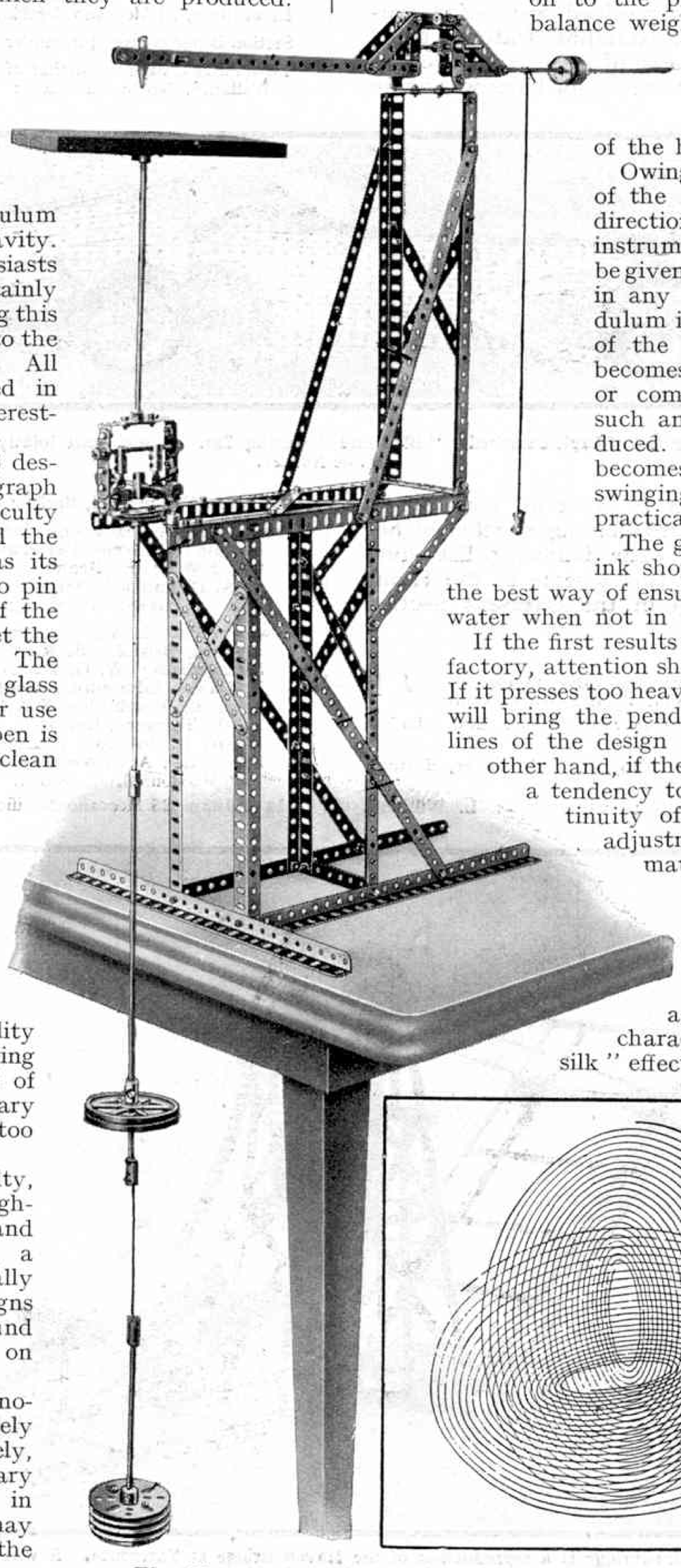
Owing to the knife-edge pivots, the table of the Harmonograph is able to move in all directions quite freely. In order to set the instrument in operation the pendulum should be given a gentle but steady swinging movement in any direction. When the secondary pendulum is given a different movement from that of the primary, the movement of the table becomes very complex, and it is this double or compound pendulum effect that enables such an endless variety of designs to be produced. After a small amount of practice it becomes easy to set the compound pendulum swinging in the correct manner to produce practically any pre-determined design.

The glass pen itself needs a little care. The ink should never be allowed to dry in it, and the best way of ensuring a clear tube is to keep the pen in water when not in use.

If the first results obtained from the model are not satisfactory, attention should be given to the balance of the pen. If it presses too heavily upon the paper the resulting friction will bring the pendulum to a standstill quickly, and the lines of the design will be spaced too far apart. On the other hand, if the pressure is too slight the pen will show a tendency to jump up and down, so that the continuity of the design will be broken. A little adjustment of the balance weight will put matters right in this respect.

Perhaps the most interesting results are obtained by super-imposing two or more designs, as in the specimen design illustrated here. These composite designs may be made in a really amazing variety. Their most characteristic feature is the "watered silk" effect that is frequently produced, especially when the individual designs that are employed are similar in type. Interesting effects may be obtained by superimposing designs made in inks of different colour.

The instruction leaflet referred to in the foregoing remarks is the Special Instruction Leaflet No. 26, Meccano Twin-Elliptic Harmonograph, which may be obtained from any Meccano dealer, price 2d., or direct from Meccano Limited, Old Swan, Liverpool, price 2d. post free.



The Meccano Harmonograph and a specimen design.

Results of Meccano Model-Building Contests

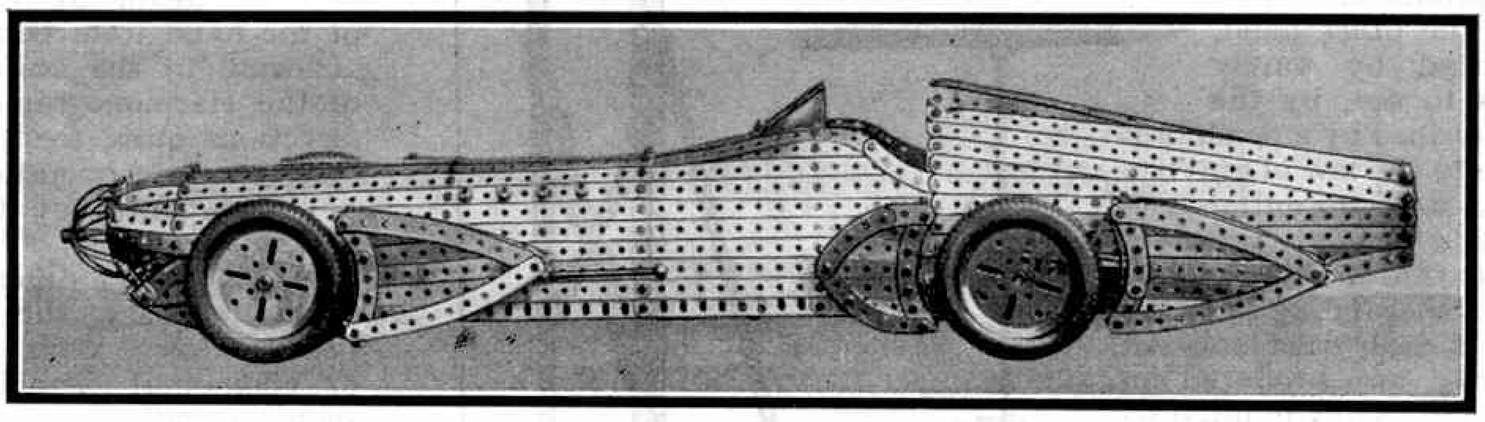
By Frank Hornby

"Autumn" Competition (Home Sections)

IN the "Autumn" Contest we reverted to the type of competition in which any kind of model may be entered or any number of parts used, and the tremendous number of entries received indicates that this is the most popular type of all. The reason for its popularity probably lies in the fact that competitors are allowed full rein for the development of their own ideas and methods of construction. The entries received were of a particularly high standard, their most outstanding features being originality of design and the soundness of their construction.

The fact that Meccanoites are never hard up for ideas was again proved by the variety of subjects represented by the entries, of which some remarkable prize-winning examples are illustrated on these pages.

The task of allocating the various prizes was made extremely difficult owing to the fact that several models were of equal merit. Instead of awarding First, Second, and Third Prizes, it was decided finally in order to treat all competitors fairly, to make a number of special awards having a rather higher total value than the original prizes. The following list gives the names of the prize-winners under this scheme in the Home Sections of the Contest. The results in the Overseas Section cannot yet be published.



A Prize-winning model of Capt. Campbell's "Blue-bird" Racing Car. It was built jointly by T. B. Paisley and F. de Nolhac.

Section A (for competitors over 14 years of age).

TWO PRIZES, each consisting of Meccano Products to value £1-10s.-0d.: J. B. Frost, Newton-le-Willows; K. Garner, Bickonhill Village, Warwickshire.

TWO PRIZES, each consisting of Meccano products to value £1-1s.: Eric Whalley, Blackburn; D. M. Walbourn, Loughborough.

TWO PRIZES, each consisting of Meccano products to 15/-: Cyril Walker, Nottingham; Clement Wilson, Great Yarmouth, Norfolk.

TEN PRIZES, each consisting of Meccano products to value 10/6: L. Williams, North Kensington, London, W.10; R. P. Halls, Hampton, Mddx.; A. E. Whitworth, Brighton; Eric Campbell, Castledermot, Co. Kildare; S. H. Judson, London, N.W 5; E. W. Jay, Peckham; T. M. Jones, Oxford; T. B. Paisley and F. de Nolhac, Glasgow; John A. Sizer, Hull; R. S. Jenkins, South Woodford, E.18.

TWELVE PRIZES, each consisting of Meccano products to value 5/-: W. C. Whitelowe, Leeds; A. M. Johnston, Dunstable; John L. Redding, Bridport; Robert Philip, Brechin, Angus; John L. Fletcher, Keighley; H. B. Jones, Maybole, Ayrshire; E. H. Bradshaw, Sheffield; S. Darnell, London, N.16; R. G. Allum, Chard; W. D. Cripps, Luton; L. F. Lacey, St. Leonards-on-Sea; John C. Wilks, Ashford, Kent.

TWELVE PRIZES, each consisting of a copy of "Famous Trains" by C. J. Allen: John Scott, London, N.W.6; L. A. Mathews, Leix, I.F.S.; G. N. Rhodes, Preston; Brian G. D. Salt, Shrewsbury; W. P. Haggar, East Ham, E.6.; C. T. Glover, London, W.10; John Matthews, Coventry; R. W. Blake, Twickenham; G. Hindle, Blackburn; James Wilson, Aberdeen; E. C. M. Wake, Taunton; Harry Rutter, Consett, Co. Durham.

TWENTY PRIZES, each consisting of Meccano Engineer's Pocket Books: J. Streeter, Birmingham; V. B. Harris, Hastings; C. Wadsley, Crewe; H. G. Clements, Luton; M. I. Hill, Reigate, Surrey; J. A. Willman, Dumfries; K. G. Budden, Southsea; A. Gurney, Kirby Muxloe, near Leicester; R. J. Thompson, Norwich W. G. Wilford, Edinburgh; H. Kendrick, Walsall; R. T. F. Brown, Ringwood, Hants.; E. J. Pike, Lowestoft; F. A. D. Sadler, Four Oaks; J. Stead, Cranleigh; James F. Huson, London, S.E.19; William Finlay, Glasgow; A. F. Watson Reading; P. Colebrook, London, N.2; F. A. Burt, Birmingham.

In addition, 25 Meccano Certificates of Merit will be awarded.

Section B (for competitors under 14 years of age).

TWO PRIZES, each consisting of Meccano products to value £1-1s. A. McGregor Wallsend, Northumberland; D. G. Furneaux, Sheerness, Kent.

TWO PRIZES, each consisting of Meccano products to value 15/-: S. Smith, Edinburgh; P. R. Nichols, Teddington.

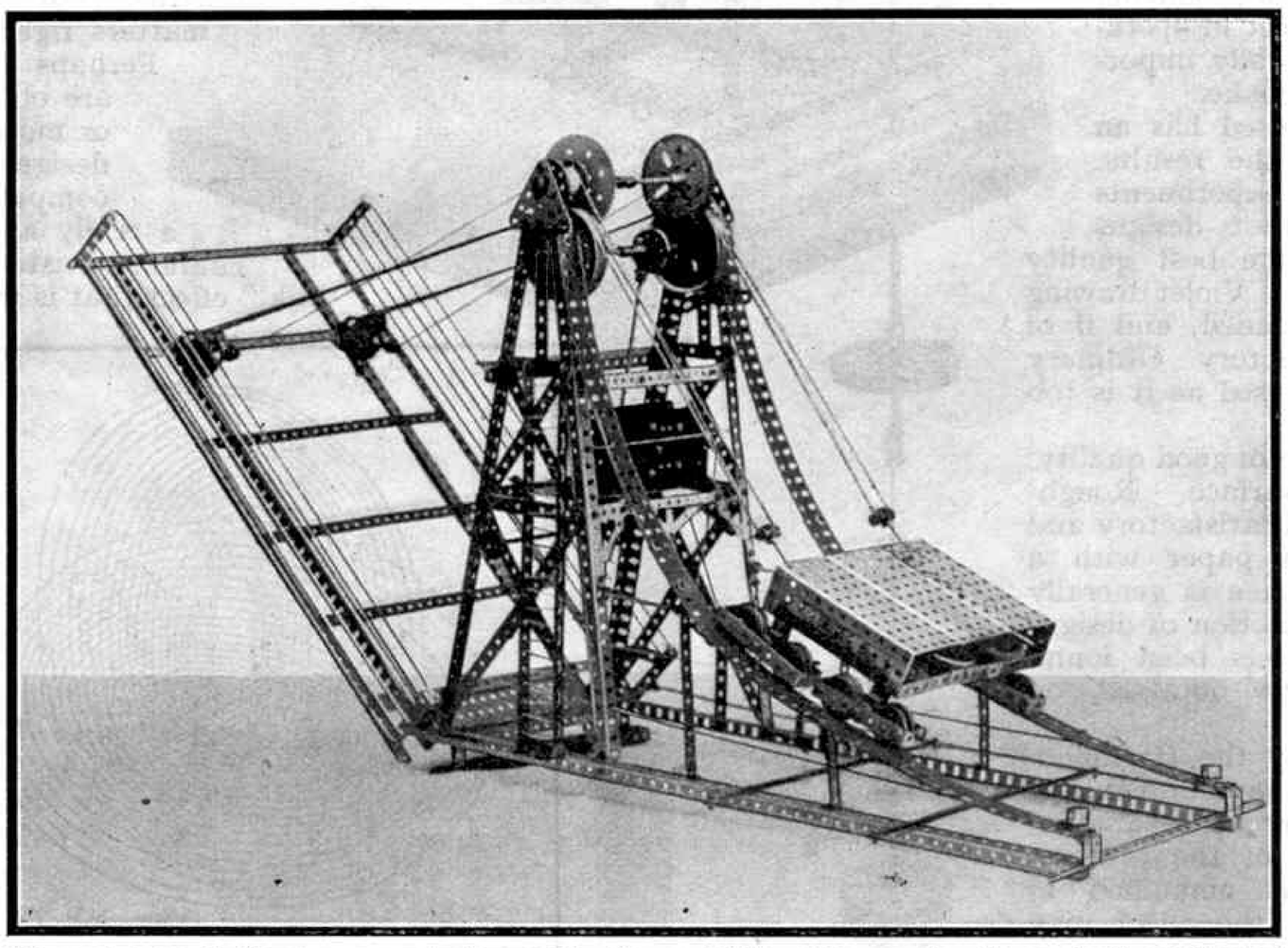
TWO PRIZES, each consisting of Meccano products to value 10/6: M. H. Edmonds, Oundle, Northants; Albert Emmett, Radford, Nottingham.

SIX PRIZES, each consisting of Meccano products to value 5/-: C. Fowler, Aberdare; G. Goodyear, Alderley Edge; D. E. Tweedale, Marland, Rochdale; John and Colin Fairrie, Seaview, Isle of Wight; R. Michael Latter, Wallingford, Berks.; S. Lloyd Phillips, Ware, Herts.

TWELVE PRIZES, each consisting of "Famous Trains" by C. J. Allen: Jack Edwards, Brechin; C. Evens, Peacehaven; B. Heath-Brown, Tilford; J. E. Weaver, Brixton, S.W.2; E. Bennett, Tunbridge Wells J. Sturrock, Barrow-in-Furness; N. A. Drummond, Bearsden; P. A. Rodgers, Sheffield; W. Z. Cook, London, W.3 R. Grant Aberdeen; D. Stoneley, Southampton; J. Call, Dorking.

TWENTY PRIZES, each consisting of Meccano "Engineers' Pocket Book": J. and B. Pippard, Bristol; B. R. Williams, Bristol; R. Hirst, Chesterfield; E. Inglis, Birmingham: W. G. Barton, Wembley Park, Middlesex; H. Byrne, Mossley; E. Dawes, Edmonton; Gordon G. Wilkins, Redditch; N. Sly, Croydon; C. J. Greening, Wimbledon, S.W.19; Neil McNeil, Ayr; G. Greenwood, Blackburn; H. W. Torrance, Bearsden, near Glasgow; H. Thistlethwaite, Barnard Castle; W. H. B. Johnson, Charterhouse, Godalming; G. Wilkinson, Bearsted, near Maidstone; A. E. Wedge, Shifnal C. S. Gibberd, Coventry; M. Pelham, Horley Ian Macdonald, Greenock.

In addition 25 Meccano Certificates of Merit will be awarded.



This model drawbridge is a reproduction of the Haven Bridge at Yarmouth. It was built by Clement Wilson and secured a prize in Section A.

The large number of really excellent entries that have been received in the Home Sections necessitate that this article be devoted to short descriptions of a few of the prize-winning entries in Section A. Further successful models in Section A together with the principal models in Section B will be illustrated and described in next month's *"M.M."* and as there are too many fine models to include in even two articles, I intend to illustrate some of them in future issues from time to time.

Kenneth Garner, who secured one of the biggest prizes, submitted a model of quite distinct and unusual character. His entry represented a new type six-wheeled light motor vehicle, recently designed by the Garner

Motor Co., Birmingham. I consider this entry of such general interest that I intend to make it the subject of a special article in a coming issue of the "*M.M.*" and therefore I do not propose to describe it here, except to mention that among the new principles in design incorporated in the model, is a device that allows a difference in front wheel level of 1½" to 2". This is a point of considerable importance in the case of motor lorries that have to travel over rough ground, and the actual vehicle has been subjected to very severe tests by the War Office through which it passed with high honours. As I am sure every Meccano boy will be interested in hearing more of this unique vehicle, I advise readers to watch out for the special article, in which both the prototype and Garner's prize-winning model will be illustrated and described.

This contest produced two of the finest specimens of Meccano model-building that it has yet been my pleasure to receive in any contest. I refer to the two models entered by J. B. Frost and which are illustrated in the accompanying composite. The first of these is a splendid replica of an Aero Morgan three-wheel car and I think all readers will agree that the model is most realistic. Its most outstanding quality lies in the excellent manner in which each part used in its construction has been utilised. Although the most minute details of the prototype are represented, the appearance is nevertheless most pleasing in outline—a point of considerable importance, for in many models of this type the main features are submerged in a mass of ill-proportioned detail.

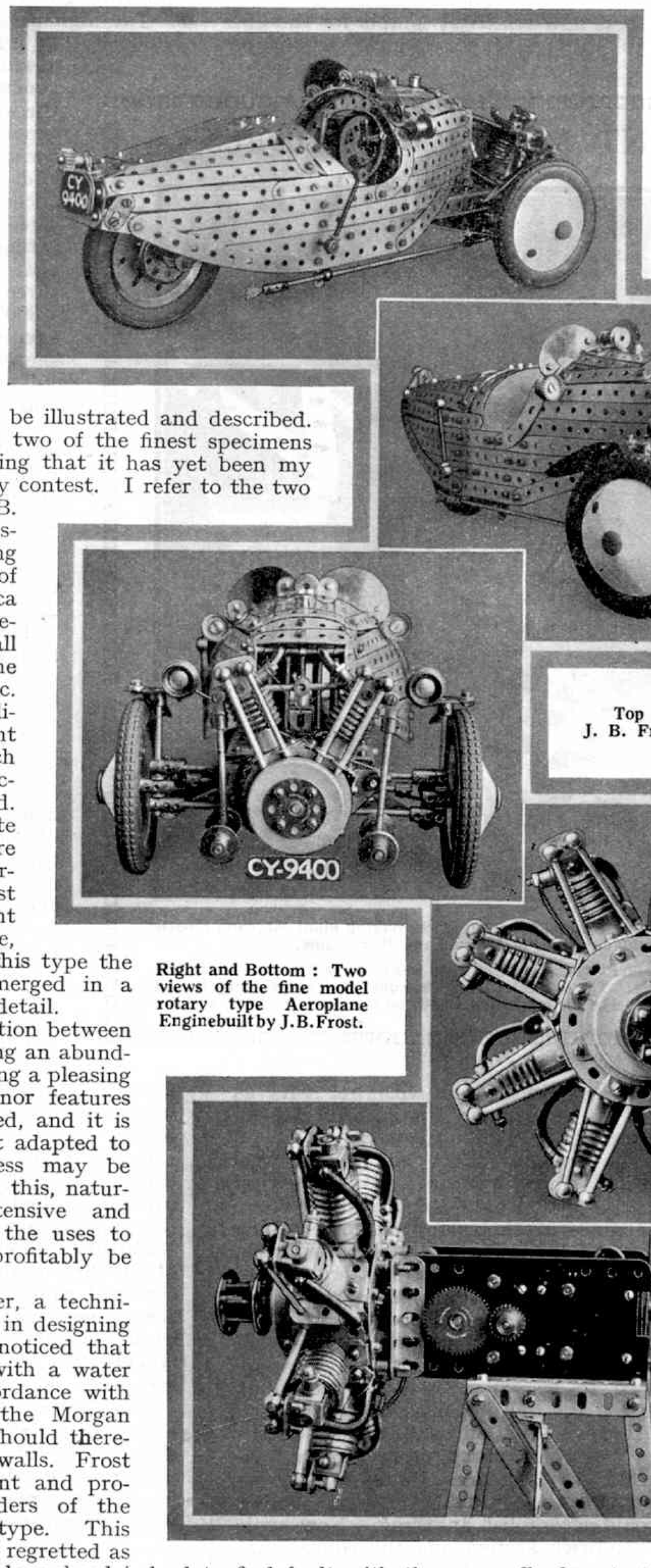
There is a vast distinction between building a model including an abundance of detail, and building a pleasing model in which the minor features are correctly proportioned, and it is only by using parts best adapted to the purpose that success may be attained. To accomplish this, naturally demands an extensive and thorough knowledge of the uses to which each part may profitably be employed in a model.

Unfortunately, however, a technical error has been made in designing the car, for it will be noticed that the model is equipped with a water cooling radiator, in accordance with the latest practice of the Morgan Coy., and the cylinders should therefore have smooth-sided walls. Frost has overlooked this point and provided air cooled cylinders of the ordinary radiating fin type. This slight inaccuracy is to be regretted as otherwise it would have been hard indeed to find fault with the constructional details of the model.

The three views of the model show fairly clearly all the items of importance. The engine fitted with overhead valves, the cylinders complete with ignition plugs, and the exhaust pipes, are features worthy of special notice.

The ¾" Flanged Wheels secured in the ends of Sleeve Pieces afford very realistic silencers, while the fish tail exhaust pipe enhances the finished effect. The constructional details of the steering gear constitute an object lesson in refinement in model-building. Meccano boys should study this model carefully.

All that can be said of this model may also be applied with equal justification to Frost's other entry ; a rotary type aeroplane engine. Particular notice should be given to the manner in which the cylinders have been devised from 1" loose Pulleys and Chimney Adaptors, and the realistic appearance of the exhaust pipes, that are reproduced with Meccano Springs. A further feature of unusual interest is the use of the shanks from Spring Buffers, to imitate the sparking plugs. The model is constructed entirely from standard parts, although a first glance is inclined to induce one to believe otherwise.



Top (two views) and left : J. B. Frost's model Aero Morgan.

Right and Bottom : Two views of the fine model rotary type Aeroplane Enginebuilt by J.B.Frost.

Eric Whalley's entry takes the original form of a model Vertical Drilling Machine and provides an excellent example of the educative value of the Meccano system when used for constructing mechanisms of this kind. The model is patterned on the type of machine manufactured by Archdale Limited (Birmingham) for use in foundries and general engineering machine shops. A wonderful gear box is fitted that gives a range of nine different speeds of the drill mandrel and a separate gear box is provided for driving the spindle feed mechanism.

This latter gear box is mounted at the right-hand side of the spindle and incorporates two speeds either of which are brought into operation by movement of a crank lever, conveniently situated. The gears give cutting ratios of 1" per 75 revolutions and 1" per 50 revolutions, of the drill spindle. Another lever throws the main drive out of gear so that it is possible to bring a secondary drive into operation for very fine and sensitive drilling work. A friction clutch operated by a lever stops or starts the machine at will.

The drilling table, which is of the revolving pattern, rotates on a pin, and the table support is so arranged that it may be swung out of position in order to accommodate bulky work which is placed upon the base plate of the machine and the drill spindle adjusted accordingly. Both the table and base plate are fitted with inverted "tee" angle-slots so that "tee" bolts may be used to clamp the work to be drilled in position.

The framework of the machine is solidly constructed from Angle Girders braced efficiently with Strips and the mechanism, which, by the way, is situated mostly at the upper part of the machine, is encased with various Flat Plates that not only afford protection to the gears, etc., but also enhance the appearance of the finished model. Whalley is to be congratulated on his very praiseworthy effort.

A well built and unique model of a counterbalanced drawbridge (illustrated herewith) brought success to Clement Wilson, who informs me that his entry is a reproduction of the temporary Haven Bridge that spans the River Yare at Yarmouth. The constructional details of the single leaf, winding gear and movable counterbalance are shown clearly in the photograph.

Famous Inventions—(*Continued from page 116*)

be very greatly reduced.

The torpedo's course is kept straight by a gyroscope, which is simply a spinning top. In its usual form a gyroscope is a flywheel with a heavy rim mounted on gimbal bearings that allow it freedom of movement in three directions. The axis around which such a flywheel rotates has a tendency to remain pointing in a fixed direction of space. It is this that makes possible the employment of the gyroscope as a compass, and advantage also of it is taken in steering torpedoes.

The gyroscope of a torpedo consists of a small flywheel weighing about 2 lb. that is mounted in gimbal rings in order to give it the necessary freedom. Its running speed is about 18,000 r.p.m. When the torpedo is about to be used, and while it is still in the impulse tube, the flywheel is set in rotation by a jet of compressed air. The starting speed of about 10,000 r.p.m. is attained in about one-third of a second. When this rate of spin is reached the suspension of the flywheel is unlocked, and the steering gear immediately begins to operate.

The manner in which the gyroscope keeps the torpedo to its intended direction is easy to follow. The axis of an accurately balanced flywheel should continue to point in the same direction throughout the run, and thus the wheel itself will rotate in the same plane as that in which it turned when the torpedo was shot out of the tube. If at any time during the run the missile deviates from its intended direction, the gyroscope wheel does not turn with it, but strives to remain in its original plane. When the torpedo turns, therefore, the gyroscope wheel remains in its original position and comes in contact with a cam that operates a small slide valve that admits air to a steering cylinder. This in turn moves the vertical rudders and brings the torpedo back into line.

A torpedo may be fired by compressed air from the submerged impulse tube of a submarine, or from the deck of a destroyer, where the impulse tube may be 16 ft. above water; or by more complicated methods adopted on larger ships. In any case this wonderful piece of mechanism is required to spring to full speed instantly, to have its gyroscope in action to correct the first deviation, and to find its proper depth.

An interesting point is that before insertion into a tube in readiness for discharge, the propeller blades are placed in a position that will guard against the engine being on a dead point at starting. The position of the blades necessary to avoid this is indicated by arrows.

The efficiency and destructive power of a modern torpedo has made it necessary to devise means of protection for warships. The problem is a difficult one, and up to the present the most successful solution is to equip the vessels with huge wire nets. The torpedo nets, as they are called, are swung out around the ship by lengthy steel booms to intercept the missile.

GIANT MECCANO MODELS

Here the busy carpenters are at work making giant Meccano models for the Meccanoland Scene at Drury Lane Pantomime.

The Meccano Parts are made of wood and every part is made accurately to required scale. The carpenter is drilling equidistant holes in huge braced girders for a model of the crane that stands on the bench in front of him.

Women and Civil Engineering—

(*Continued from page 109*)

will have to take their share of whatever comes."

Lady Moir apparently has no doubt as to the mental capabilities of the modern girl, for she proceeded:—

"It is now relatively simple for the girl to go through the technical school or college education, and with her wits as bright as any man, obtain a degree in engineering at some university.

"The training of an engineer on the practical side, involving as it does—if properly carried out—work in the factory and engineering shop along with the working man of to-day, is a very tedious business, though lightened to a large extent by the reduction in the number of hours worked per week. To-day with our 48-hour week and beginning work at 7 or 8 o'clock in the morning is very different from what it used to be when everyone started at 6 o'clock and did not finish until 5.30.

"However, it is all to the good if knowledge can be acquired more rapidly. In the old days it was thought that an apprentice must work seven years before he could accomplish anything. Now, with our sandwich system and the educational establishments, practical work can be undertaken, interwoven with theoretical training, and the knowledge gained can be immediately applied to the problems that surround an engineer in the early days of his career."

For permission to print this address, and also to reproduce the portrait of Lady Moir, we are indebted to the courtesy of "*The Woman Engineer.*"

Chicago Turbo-Generator—

(*Continued from page 121*)

to operate at from 10 to 11½ per cent. above normal speed, and are arranged so that the tripping of either stop will close the high pressure throttle valve and the three high pressure governor valves simultaneously.

The high pressure turbine, operating at 1,800 r.p.m., drives a main generator, an auxiliary generator and a main generator exciter arranged in the order named. The main generator has a rating of 44,000 kw. at 85 per cent. power factor and produces three-phase 60-cycle current at 12,800 volts. The auxiliary generator has a rating of 4,000 kw. at 70 per cent. power factor and produces three-phase 60-cycle current at 2,300 volts. The main generator exciter is a 150 kw. 250-volt shunt wound machine.

The intermediate low-pressure and the low-pressure turbines are arranged in tandem to run at 1,800 r.p.m. and drive a main generator with a rating of 56,000 kw. at 85 per cent. power factor, producing three-phase 60-cycle current at 12,800 volts; and a main generator exciter, which is a shunt-wound 225 kw. and 225-volt machine.

The overall length of the high-pressure unit is 75 ft. 11¾ in.; overall width 13 ft. 8 in.; and height 11 ft. 2⅝ in. The corresponding dimensions of the low-pressure unit are length 86 ft. 1¾ in.; width 37 ft. 2 in. (including condensers); and height from floorline to top of condensers 15 ft. 1½ in. The total weight of the entire unit, including turbines and generators, is 2,100,000 lb.

U.S. Engine Design—

(*Continued from page 117*)

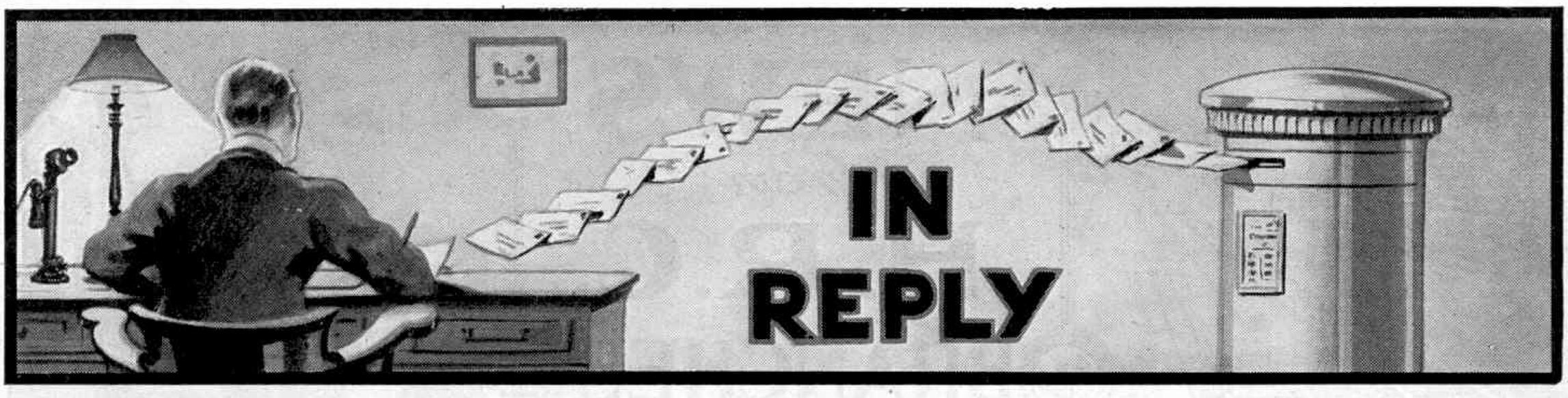
been in service between Washington and New York for the past two years or so; but there is a decided economy in fuel and water on the "*President Cleveland*" by reason of the water tube firebox and exhaust steam injector. This locomotive can easily develop 70 miles an hour, and is capable of higher speeds; but it is not the practice on the Baltimore and Ohio Railroad to exceed this figure. Some idea of the size of the driving wheels may be obtained from the fact that the diameter is 8 in. more than the height of a 6 ft. man; while for each revolution of the driving wheels the locomotive advances a distance of about 22 ft.

During the designing of the "*President Cleveland*" special attention was paid to the placing of the operating levers and valves in the cab so that all of these should be within convenient reach of the driver from his position on the seat box.

Diesel Engine Booklet

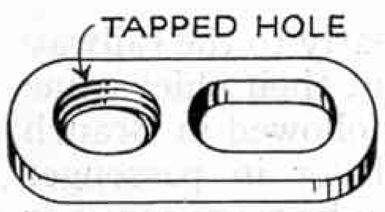
Messrs. Sulzer Bros., of 31, Bedford Square, London, W.C.1, have sent us a copy of a little booklet entitled "Sulzer Diesel Engines." This booklet is well illustrated and will be welcomed by any of our readers interested in the subject.

A copy will be sent free on receipt of a request, on condition that the "*Meccano Magazine*" is mentioned.



READERS' SUGGESTIONS FOR MECCANO IMPROVEMENTS

THREADED FLAT BRACKET.—We are interested in your proposal re a new type flat bracket. As shown in the accompanying sketch, the bracket would be of similar dimensions to part No. 10 with the exception that it would be cut from much heavier metal. The article would have a slot and circular hole cut in it, the latter being tapped to take standard Meccano bolts, Screwed Rods, etc. By means of the tapped hole, it would be possible to lock the article to a rotating member and it could thus be used as a cam. Several other uses could no doubt be found for a part of this type, but in most cases its functions are already covered by existing accessories. We regret therefore that we cannot give further attention to the idea. (*Reply to F. C. Glass, Pernambuco, Brazil*).



SPECIAL PLATES.—There would be very few uses for the specially shaped plates that you have designed. We consider it a much better plan to build up specially shaped plates, when required, from the existing structural parts. (*Reply to W. F. G. Maynard, London, S.E.3*).

DRY CELL.—Your suggestion that a special 6-volt dry battery should be introduced is quite interesting. You mention that the cell could be encased in a metal container, fitted with drilled lugs, in a similar manner to certain makes of radio high-tension batteries now on the market, and this provision would certainly make the cell very handy, for it could be mounted in any position in a model. A battery of this type could not, of course, be employed to supply current to the Meccano Motor, as the current taken by the latter is comparatively large, and a secondary cell is the only satisfactory means whereby the motor can be run economically. Your idea is under consideration. (*Reply to R. O. Miller, Providence R.I., U.S.A.*).

IMPROVED WINDING KEY.—To enlarge the end of a Clockwork Motor winding key so that it might fit over standard nuts is quite a good idea. The decision as to whether this suggestion could be adopted lies in its practicability from a production standpoint, but we hope to look into the idea thoroughly in the near future. (*Reply to A. Williamson, Dunston*).

SPECIAL CONTAINERS.—We note your idea that we should introduce special containers without perforations that could be employed to represent water or petrol tanks in Meccano models. We do not consider that it would be advisable to do this, however, as even if filled with liquid, these articles would serve no useful purpose, while the absence of holes would make it a very difficult matter to secure them rigidly in a model. Your idea to use the container in a model of a street-watering machine is certainly novel, but a special accessory part could not be produced for use in one model alone, and we do not consider that Meccano can be used successfully in models where water or other liquids are present. We think you will find it a much better plan to use the Meccano Boiler (part No. 160) when a tank or receptacle for liquids is to be represented. The perforations in the sides and ends of the Boiler make the latter part very adaptable for use in a large number of models. (*Reply to Dante Pentimalli, Messina, Italy*).

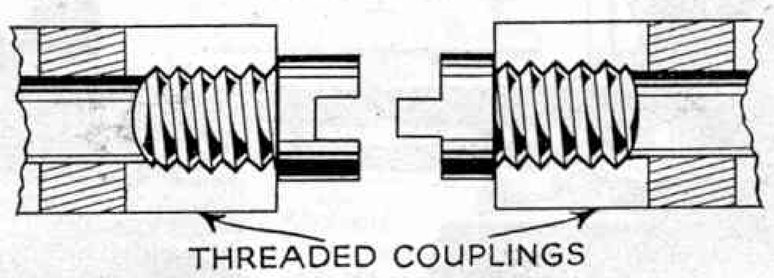
RUBBER TUBE.—This would not be a suitable addition to the system, as tubing of any kind is never required in general Meccano constructional work. If you particularly require this material for a special model we suggest that you use acetylene or cycle valve rubber tubing which may be obtained quite cheaply. (*Reply to J. H. Axby, Finchley, N.2*).

ALTERATION TO SCREWDRIVER.—We note that you consider that a set-screw should be fitted to the handle of the all-metal Screwdriver (part No. 36b) so as to prevent the shaft from slipping out when in use. We do not think this is necessary, however, as this article is manufactured so that the blade of the driver is a tight fit in the slotted hole of the metal handle. You mention that you have coated the end of the blade of your screwdriver with lubricant, and this is undoubtedly the reason for the halves not holding together securely. (*Reply to D. A. J. Stork, Upper Teddington, and D. E. Cantle, Birmingham*).

CENTRIFUGAL GOVERNOR.—We note you suggest that a complete centrifugal governor should be introduced, but we are not in favour of this as this mechanism can be reproduced from standard parts. A centrifugal governor similar to that used in a gramophone motor was described in last month's "Suggestions Section," while a further example of the application of this principle will be found in the "tachometer" or speed indicator shown in this month's "New Models" article (see page 129). Either of these mechanisms function quite as efficiently as a specially manufactured unit. (*Reply to V. Lavender, Torquay*).

SINGLE FLANGE PLATE.—The uses of $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Plates having a flange on only one side, are amply covered by the existing $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate and built-up plates using Angle Girders and Flat Plates. (*Reply to K. Parker, Adelaide, Australia*).

COMPACT DOG CLUTCH.—We have inspected your design for a smaller pattern of dog clutch unit and find it quite interesting, but we do not think it constitutes an improvement over the existing Dog Clutch (part No. 144). For the interest of other readers we are including a sketch of the proposed unit, from which it will be seen that the halves of the clutch would resemble standard bolts having a slot and projection cut in their "heads." Such parts would certainly form a neat and compact clutch unit, but the difficulty would be in attaching them to other Meccano accessories. The only practical method



that there appears to be of doing this, would be to screw the members into the threaded longitudinal bores of Threaded Couplings, as shown in the sketch. It would then be possible to fasten the members to standard Rods, etc., but the complete unit would be far clumsier and more costly than the existing dog clutch! It would obviously not be advisable to introduce parts of this type. (*Reply to J. Eccles, Darlaston*).

ALTERATION TO GEAR.—We do not consider it advisable to drill a series of holes in the face of the 50-teeth Gear Wheel, in a manner similar to the 57-teeth Gear, as the former wheel is considerably smaller in diameter than the 57-teeth Gear, and the holes would consequently "foul" the teeth cut in its periphery. (*Reply to J. W. Graham, Auckland, New Zealand*).

SPRING SHEATHING.—We have noted your idea regarding the introduction of lengths of coil spring that might be used in "Bowden" control mechanisms and flexible driving gears. An example that we have in mind, where Bowden sheathing and wire is essential, is the Mechanical Screwdriver, described in the May 1929 "Suggestions Section." Doubtless a number of other uses could be found for this type of article, although we would remind you that a form of Bowden flexible drive can be reproduced with standard Spring Cord and Bare Iron Wire. This drive can only be used for transmitting a very light torque, and we therefore intend looking into your idea at the earliest opportunity. (*Reply to G. E. Reynolds, Edgewood, U.S.A.*).

IMPROVED BOILER END.—To punch a number of holes in the rim of the Meccano Boiler End (part No. 152a), is quite a good idea. Other Meccano parts could then be bolted to the rim, and this article would then be considerably more adaptable than in its present form, and could be used in a number of models in addition to its original function as an end cover for the Boiler. (*Reply to F. Reid, Napier, New Zealand*).

LARGER SLEEVE PIECE.—Your suggestion that a larger edition of the Sleeve Piece should be produced, which might be fitted over the $1\frac{1}{8}''$ Flanged Wheel, is quite interesting but it would be difficult to find many uses for a part of this type. However, we are making a note of your idea. (*Reply to K. Parker, Adelaide, Australia*).

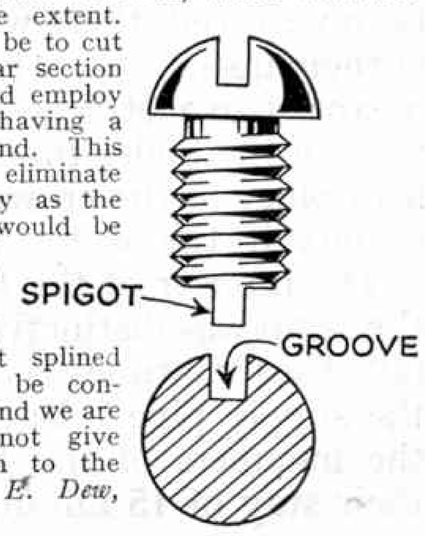
NEW GEAR DRIVE FOR CLOCKWORK MOTOR.—We are very interested in your method of obtaining a slow drive of exceptional power from the spring of the Clockwork Motor, *i.e.* by securing a 1" Gear Wheel on a shaft journalled in the Motor side-plates so that the Gear Wheel meshes with the large toothed gear (fitted with pawls) that forms the primary wheel in the train of gears that is driven by the spring. The torque of the spring is thus transmitted to the driven shaft without the usual "stepping up" of speed, and the friction between gears that occurs when the complete train is used, will not, of course, be present. We recommend other model-builders to try out this idea for themselves, although they must not expect the slow, powerful drive so obtained to last very long before rewinding! (*Reply to Louis Felix, Marseille*).

"THE INSTITUTE OF MECCANO ENGINEERS."—We much appreciate your comments on the idea for an "Institute of Meccano Engineers" that was published on this page of the December Magazine. We quite agree that it would be advisable to omit the age limit in the various sections, and we do not also consider that the Outfits which boys possess should have any bearing on their eligibility for the various sections, as this would give unfair advantage to certain constructors. We are making a note of your suggestions and shall be pleased to receive the opinions of any other readers interested in the scheme. (*Reply to B. D. J. Rowe, Ilford*).

MECCANO MASCOT.—Instead of our manufacturing a special mascot, why not build one for yourself from standard parts? Some excellent examples of very small aeroplanes, motors, etc., have been illustrated in the "*M.M.*" recently and these could, with very little trouble, be adapted for fitting to the handle bars of cycles or motor-cycles or to the radiator cap of a motor car. In the latter case it might be advisable to use nickelled parts to "tone" with the metalwork of the car, or enamelled parts could be coated with aluminium or silver paint. (*Reply to E. J. Chamberlain, Solihull*).

SLOTTED RACK STRIPS.—We do not consider that it would be advisable to cut slots in the Rack Strips as you suggest. If slots were cut in these parts, they would somewhat facilitate adjustment, but there would be considerable difficulty in fastening the parts securely. An instance that occurs to us where a slotted rack would be useful is in the device for increasing the length of a crank stroke (see Standard Mechanisms Manual, S.M. 278). In most cases, however, the Racks are required to be stationary and Pinions or Gear Wheels rolled over their teeth, and for this reason we consider it best to hold to the existing method of perforating these parts. (*Reply to Hugh Rodgers, London, N.W.*).

IMPROVING THE "SPLINED-SHAFT SUGGESTION."—To cut grooves in the Meccano Rods and insert the grub screws of Gear Wheels into them, thus forming the equivalent of fluted shafting with sliding gears for use in gear boxes, is, as has been pointed out previously in these pages, not a practical proposal for various reasons, chief of which is that the end of the bolt tends to bind in the slot cut in the rod, making it impossible to slide the gear when required. It would also be difficult to journal the grooved rods satisfactorily, as the edges of the grooves, when rotating, would tend to cut away the journals. We agree that your proposed modification of this idea, which we illustrate herewith, would eliminate the trouble to some extent. The main idea would be to cut a groove of rectilinear section in a standard rod and employ a special set-screw having a "spigot" cut on its end. This would theoretically eliminate any binding tendency as the surfaces in contact would be parallel to each other. The diameter of the Meccano shafts is, however, far too small to allow an efficient splined shaft mechanism to be constructed in this way, and we are afraid that we cannot give any further attention to the proposal. (*Reply to E. Dew, London, W.6*).



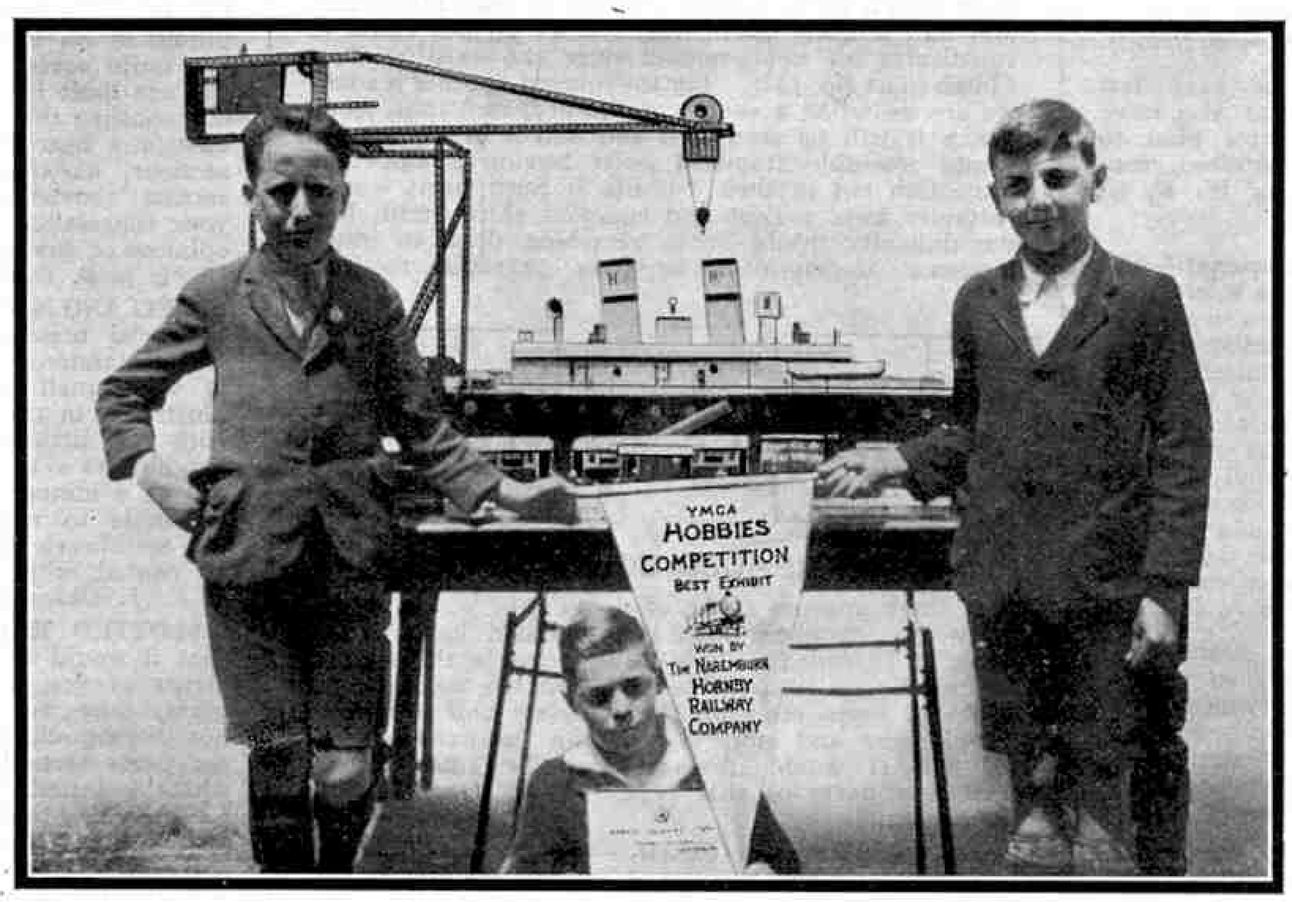
Inside the Firebox of a Locomotive!

I am very pleased to find that the advice I gave some months ago to " prowl around " stations, goods yards and locomotive sheds has been followed by many Branches, the members of which have picked up an astonishing amount of interesting and useful information on working railway practice. Other Branches have been even more fortunate, for they have been given access to railway workshops. For instance, the members of one club were given the opportunity of making a very thorough inspection of the interior of a locomotive, a foreman boilersmith at the local engine shed very kindly giving up a free afternoon in order to act as guide.

With the thoroughness that is characteristic of H.R.C. members, the visitors changed into overalls in order to be able freely to enter every nook and cranny of the locomotive selected. This was of the two-cylinder 4–6–0 type. Following their guide on to the footplate of the locomotive, members were shown the controls and the use of everything on the footplate from the whistle chain to the lubricator box was explained to them.

Then came the moment to which they had looked forward. The guide dropped on his hands and knees and crept feet first through the firehole doorway. One by one the visitors followed him and as the brick arch had been removed, there was room for an astonishing number of them inside the firebox. Illumination was provided by means of an acetylene lamp and members had a wonderful view of the boiler tubes, superheater units, stays and the lead plugs in the crown that prevent burning-out of the firebox if the water level in the boiler falls too low.

The interior of the firebox was sooty and the smell of the lamp was distinctly unpleasant. In addition the light failed several times because members of the party trod on the supply pipe! But these drawbacks did not prevent the members of the Branch from thoroughly enjoying their stay of 15 minutes in the firebox.



Members of the Naremburn (N.S.W.) Branch with a liner and other interesting models constructed by them. Our photograph also shows the Pennant recently won by this Branch for their miniature railway display at Sydney Y.M.C.A. Hobbies Competition.

Making the Best of Railway Visits

Visits such as that described add greatly to the railway knowledge of members of Branches, but their chief value is in providing actual examples to be followed in Branch work. Track layouts in goods yards or in passenger stations that are of special interest may be reproduced as far as possible and efforts should be made to run trains on this miniature track in accordance with actual practice.

In this connection I strongly advise those who visit railway stations to follow the example of one club, the members of which are very thorough in everything they do. They are not content merely to watch and to try to remember, but make sure of their facts by drawing plans and making careful notes on the spot in regard to everything they see.

For such a purpose as this a notebook bound in strong boards is necessary. One that is very suitable for this purpose is the Meccano Engineer's Pocket Book, the great advantage of which is that the squared paper it contains enables proportions to be indicated very accurately. Use may be made of it for sketching interesting track layouts, and also the chief features of lineside structures, signal gantries and other objects, models of which would make desirable additions to the Branch layout.

Copies of the book may be obtained direct on application to Meccano Limited, Binns Road, Old Swan, Liverpool, price 1/– post free.

Value of Branch Photographs

I should like to remind Chairmen and Secretaries of Branches of the value of good photographs that may be reproduced in the "*Meccano Magazine.*" The appearance in the pages of the "*M.M.*" of a group photograph or, better still, of an outdoor railway scene in which members figure, always creates great enthusiasm among members and stimulates their interest in the activities of the Branch. An even more effective type for this purpose is one showing the Branch layout actually in operation.

Branch Notes

PERSHORE.—A wide shelf is being erected on which the permanent track of the Branch is to be laid. A special feature is timing express trains to scale. The speeds in miles per hour of each locomotive are worked out and timetables are drawn up from the schedule thus obtained. A combined Meccano and Hornby Train Exhibition has been held, the proceeds being in aid of Branch funds. New members will be cordially welcomed. *Secretary :* David Cross, Church Street, Pershore.

FARNHAM GRAMMAR SCHOOL.—Very successful meetings have taken place. At one of these 21 locomotives and nearly 50 trucks were run on a large track with three stations. At another a track with two goods and passenger termini and a through passenger station with goods yard was laid down and interesting operations carried on. Speed trials of locomotives also have been conducted. *Secretary :* H. S. North, "Karind," Boundstone, Nr. Farnham, Surrey.

HENDON.—A highly successful Exhibition has been held, the central feature of which was a 28-ft. railway layout. Trains were sent off every two minutes and during intervals in the proceedings the chief features of the track were explained to the visitors. Great interest was taken in the station, the details of which were very realistic. A large number of working Meccano models were demonstrated by members. Proceeds amounted to £6, and this sum has been devoted to the purchase of Branch track. A very interesting visit was paid to the South Kensington Museum, special attention being paid to the model of the "*Rocket*" and other exhibits of historical interest. A knowledge test was set on the visit to the Museum. *Secretary :* A. Needell, 1, Sunningfields Crescent, Hendon, N.W.4.

THE HALL (SYDENHAM).—Experiments have been made with several layouts and one has been selected for permanent use. This is to be laid on tables instead of on the floor. Time-table working and signalling are regular features of Branch work, and electric lighting has now been installed in the club room. An Exhibition is to be held shortly in aid of Branch funds. *Secretary :* J. D. Davies, 28, Kingsthorpe Road, Sydenham, London, S.E.26.

IPSWICH.—Many interesting lectures on railway matters have been given, and a debate on "*The Best Means of Transport*" was held at one meeting. The Branch now boasts a girl member who is making herself useful by typing Branch reports, etc. The Chairman has erected a shelf on trestles on which the Branch railway is to be laid. Scenery is being prepared to add to the realism of the layout, and a repairs fund is to be started. Accessories such as cattle pens, platforms, factories, coal offices, etc., are being made by the members. *Branch Secretary*, P. E. Buck, 10, Dial Lane, Ipswich.

ST. CHAD'S (WITHINGTON).—Permission has been obtained for a visit to the Longsight Engine Sheds. Arrangements are being made to hold an Exhibition and timetables are being made to enable the layout to be operated by 2, 3, 4 and 5 members respectively. A library containing 30 books has been started. *Secretary :* R. W. T. Mackley, 24, St. Chad's Road, Withington, Manchester.

OVERSEAS

NAREMBURN (N.S.W.).—Sandyville Station has been turned into a seaport and the Chairman has constructed a scale model of a two-funnel liner, 6 ft. 6 in. in length and complete with lifeboats and wireless. The masts are fitted with Meccano derricks. The ship was put into service on the 22nd November. Members visited the Kogarah Branch, when locomotive tests were carried out on a combined layout, these including races, and also trials of strength between engines. A return visit is to be paid, when the new liner will be displayed to the visitors, and boat specials will be run for their benefit. *Secretary :* Ronald Pauling, 8, Glenmore Street, Naremburn, N. Sydney, N.S.W., Australia.

NELSON (NEW ZEALAND).—The railway track has been reset and timetable working has been resumed. The Secretary has given several interesting lectures on signalling to the younger members of the Branch. *Secretary :* Frank Curran, 9, Wainui Street, Nelson, New Zealand.

Members of the First Alva Branch, No. 73 : Chairman, Ex-Provost W. McArthur, J.P. Secretary, Wm. McArthur. In this Branch operations are conducted in a very practical manner, under the guidance of the Vice-Chairman, Mr. A. Stewart, who is a responsible railway official.

Further Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given here. All owners of Hornby trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who send in their applications :—

ABERDEEN—S. Jamieson, 111, Sunnyside Road, Aberdeen.

BIRMINGHAM—R. S. Smith, 72, Alcester Road, Moseley, Birmingham.

CARDIFF—A. V. Strong, 24, City Road, Cardiff.

EBCHESTER—I. Bewley, Chelmsford Hotel, Ebchester, Co. Durham.

GLASGOW, E.1—W. Crosbie, 22, Broompark Drive, Glasgow, E.1.

HARPENDEN—Wm. H. Johnson, "Bacton," Station Road, Harpenden, Herts.

HAROLDWOOD—H. B. Underwood, "Lyndhurst," Haroldwood, Essex.

HUDDERSFIELD—R. Lindley, 87, Senior Street, Moldgreen, Huddersfield.

ISLEWORTH—A. Barden, "Sylvabar," 51, Dukes Avenue, Isleworth.

LONDON, N.W.7—C. Belohoubek, 15, Russell Grove, Mill Hill, London, N.W.7.

LONDON, W.6—V. Olice, 120, Shepherd's Bush Road, Hammersmith, London, W.6.

LONDON, S.E.9—A. Pidgeon, 8, Prince Rupert Road, Eltham, London, S.E.9.

MANCHESTER—J. Noble, 37, Anson Road, Victoria Park, Manchester.

POTTERS BAR—G. R. Adye, "Bryn Rhos," Heath Drive, Potters Bar.

SHEFFIELD—Mr. E. Mellor, 116, Chelmsford Street, Attercliffe, Sheffield.

SWANSEA—L. T. Levitt, "Alpha House," Townhill Road, Sketty, Swansea.

WESTON-SUPER-MARE—C. E. Hyssett, "Bayonne," Elmhyrst Road, Weston-super-Mare.

YORK—J. D. Colman, 19, Bootham Crescent, York.

OVERSEAS

AUSTRALIA—W. McPherson Eady, 11, Sackville Street, Kew, E.4, Victoria.

AUSTRALIA—W. Jamieson, 92, Osborne Street, Nr. Williamstown, Victoria.

NEW ZEALAND—R. Dean, "Leahurst," 47, Woodward Road, Mt. Albert, Auckland.

NEW ZEALAND—William Howard, 310, Eastbourne Street, Hastings.

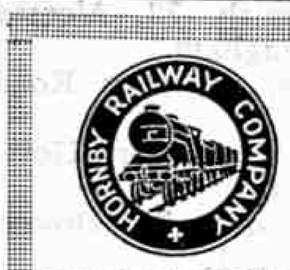
SOUTH AMERICA—Senor don Francisco Gallo, Calle No. 10, Berazategui, Buenos Aires, Argentina.

Further H.R.C. Incorporated Branches

87. FIRST RHYL—G. B. Williams, "Gorsefield," Grange Road, Rhyl, N. Wales.
88. BIDEFORD—H. L. Farr, Lavington House, Abbotsham Road, Bideford.
90. INVINCIBLE (LEICESTER).—F. C. Musson, 20, Barrington Rd., Leicester.
91. KENSINGTON—D. J. Higgens, 28, Hillersdon Avenue, Barnes, London, S.W.13.
92. WIMBORNE GRAMMAR SCHOOL—A. M. Hooper, Wimborne Grammar School, Wimborne.
93. SECOND CROYDON—Roger Stokes, "Amarah," 2, Frystan Avenue, Addiscombe, Croydon.
94. KATHLABERKE (WOTTON-U-EDGE)—R. H. M. Bennett, Church Street, Wotton-under-Edge, Glos.

OVERSEAS

89. MASTERTON (NEW ZEALAND)—Kenneth C. Bowden, 38, Pownall Street, Masterton.



MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

Hornby Railway Company

JUNIOR SECTION

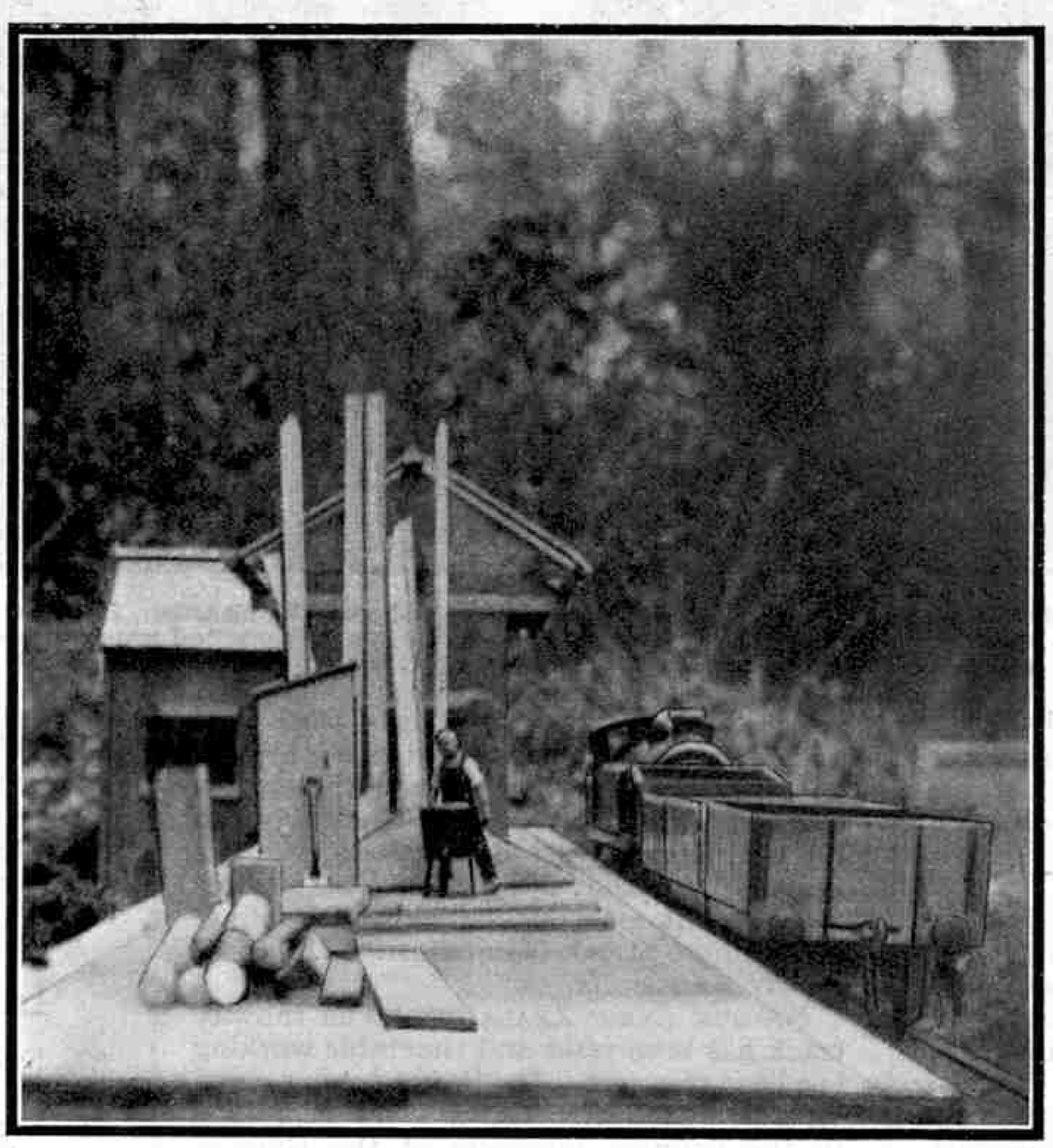
XIV.—Commencing the Model Railway Hobby

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

AT this time of the year many readers of the *"M.M."* will have become the possessors of one or other of the Hornby Train Sets, and will be experiencing the first joys of the model railway hobby. A little advice at this stage is often extremely useful in pointing out the best method of setting to work, and therefore this month we propose to deal briefly with the elements of model railway operation.

Let us suppose that we are in possession of a Hornby No. 1 Special Pullman Set. The first step to be taken is to make sure that we have every part of this set in perfect working order in order to secure the greatest possible fun from the very beginning.

We will commence by quite a simple operation—that of laying the rails. There will be found to be 12 curved rails and two straight rails in the box. These, when set out in the correct manner, will be found to make an oval track that will need a space of approximately 5 ft. 6 in. by 4 ft. 6 in. One of the straight rails, it will be noticed, is fitted with a special form of apparatus worked by a lever at the side. This is the rail for controlling a locomotive by stopping it or causing it to travel the other way, and is called the Brake and Reverse rail. The correct way to use it will be explained later on.



Extending the line ! A construction train standing at the platform of a newly-built station on the extensive outdoor model railway built up by our reader, P. Wyland (H.R.C. No. 3934).

It is important that the rails should be laid on a firm flat surface. Perhaps we may have the use of a table that is sufficiently large for the purpose, but it is more probable that we shall be obliged to lay our track upon the floor. If the rails are examined it will be seen that the sleepers are not flat but slope upward to one side, which causes the rail at one side to be higher than the other rail. In fitting the rails together by inserting the projecting peg of one rail into the hollow railhead of the next, care must be taken that all the rails have their sleepers sloping in the same direction.

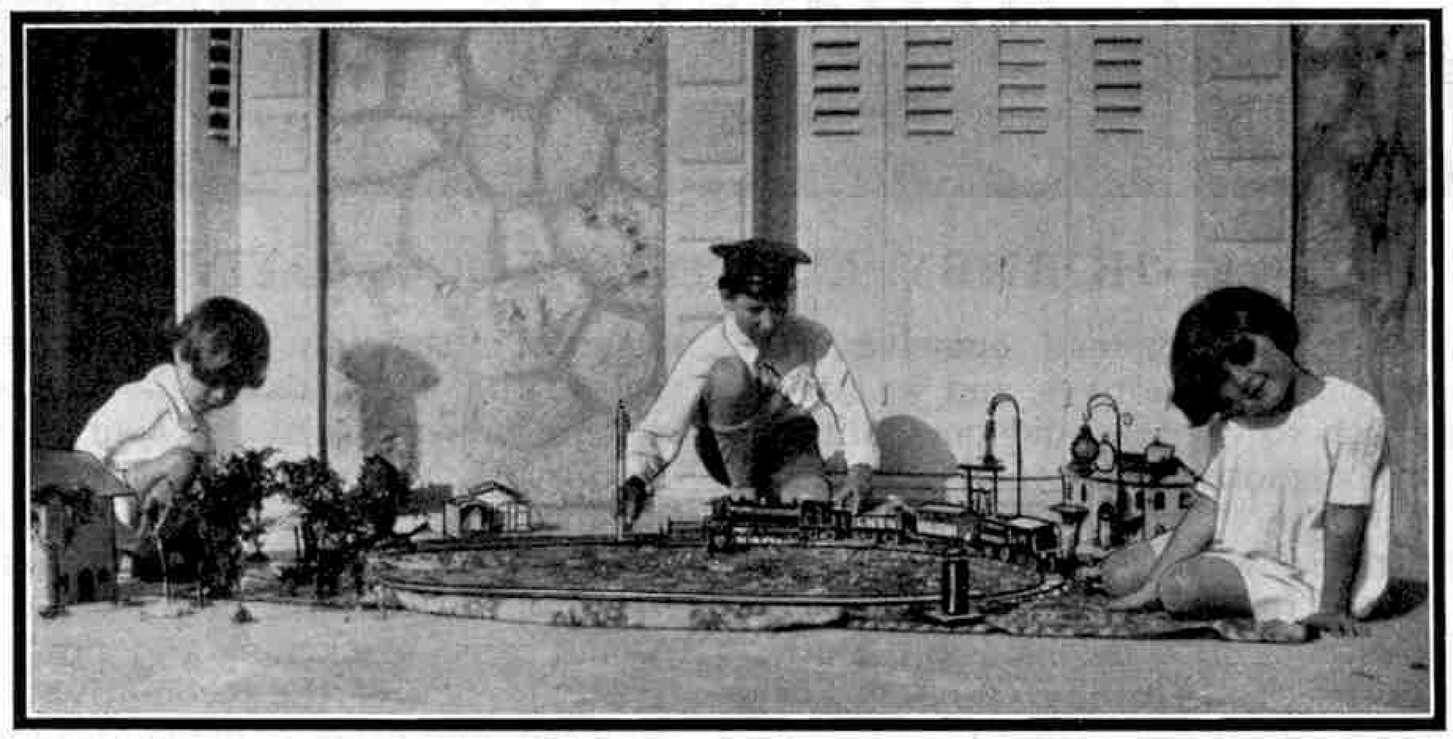
Packed with the rails in the box we find a number of what are called "connecting plates." The object of these plates is to prevent the rails from working apart, as they would be likely to do as the result of the vibration of the trains or of a slight accidental movement of the track. The connecting plates grip the end sleepers of the rails firmly together and so prevent them from moving in the slightest degree. The edges of the sleepers are turned up and the connecting plates should be slid between the sleepers so that these turned-up edges are held by the tongues of metal that are seen projecting from the base of each connecting plate. The outer turned-up edge of the connecting plate passes inside the sleeper itself. A convenient method of holding the plates is provided by a shaped piece of metal at one end, and if this is held between finger and thumb, and the connecting plates slid between the sleepers as described, no difficulty should be found in joining up the rails correctly.

Having laid down the track, it is advisable to test its correctness of gauge, that is to say, we must see that the width between the rails is exactly right so that there is no possible chance of the rails "pinching" the wheels and so causing a derailment. If the key provided with the locomotive is examined it will be noticed that the top of the handle appears to have the two corners taken off it. This is in order to form a rail gauge, for the handle is made the exact width between the rails. Thus, if the key is slid carefully along the track with the handle between the rails, the gauge may easily be checked. New rails are sometimes a little on the tight side owing to the processes of manufacture and a certain amount of springiness in the metal. If this is so, they should be gently eased outward so as to make them correct.

The locomotive, its tender and the three Pullmans may now be examined before placing them on the track. We will examine the coaches first. It is most important to see that all wheels of the coaches can revolve freely on the axles. All rolling stock is stiff in running at first, but if the wheels seem stiffer than they ought to be, the wheel frames should be examined to see if they are

pressing inward on the wheels and thus rendering them tight. If this is the case—which sometimes occurs owing to the vehicles being packed up in a box for despatch—the frames should be gently bent outward so as to free the wheels. This should not be overdone as otherwise the wheels will scrape on the frames and we shall be as badly off as before. In any case, a tiny drop of oil should be put on the axles immediately behind the wheels and the wheels should be spun round to see how they run.

Another point of importance is to make certain that the coupling hooks swivel freely, as if they do not they tend to throw the coaches out of line on curves, and possibly cause a derailment. If they are stiff, they may be freed by gently "waggling" the hooks sideways to and fro. If desired, the tiniest drop of oil may be placed on them so as to ease them, but this should be avoided if possible, as the oil tends to "creep" along the floor of the coach where it makes a mess and becomes a nuisance by collecting dust.



Interesting operations on the outdoor layout of Titaky Theotoky (H.R.C. No. 8190), Corfu. Other members of the family give valuable assistance.

The tender of the locomotive is fitted with spoked wheels, which are fixed on the axles. They should be examined for free running and the wheel frames should be dealt with in the same manner as those of the passenger coaches. The axles on these tenders run in proper axle boxes, which are packed with thin grease before leaving the Meccano Works; so that if the wheels are found to revolve freely no further attention is necessary. The couplings should be tried in the same manner as above, and freed if necessary.

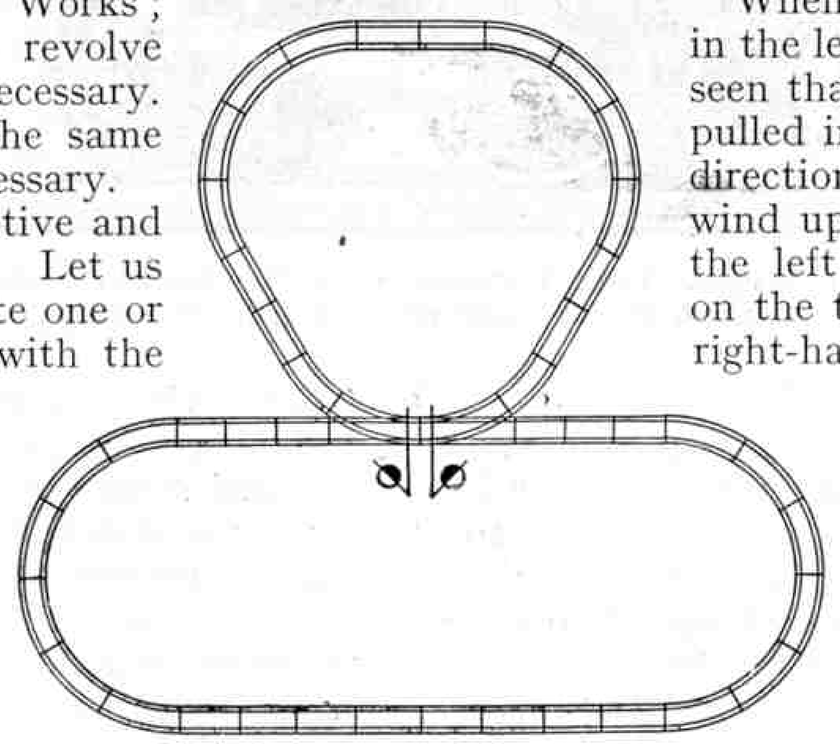
We may now examine the locomotive and see how the control levers function. Let us turn the engine upside down and note one or two points about it in connection with the brake and the reverse actions. At the leading end of the motor will be seen projecting downward a flap of metal hanging from one of the distance-pieces that hold the motor together. This is the brake trip, and if we take a glance at the Brake and Reverse rail we shall see in between the rails what appears to be a block of metal, which may be moved across from side to side by means of the lever to which it is connected. If this block, or "ramp," as it is called, is in a central position when the locomotive passes over it, the brake trip lever will not be touched by it owing to its being set to one side of the motor. Therefore the train will pass on without a pause. If the ramp is moved sideways to the same side as the brake trip, the latter will strike the ramp and the brake will be applied, bringing the locomotive and train to a standstill. To restart the train we must pull out the left-hand lever in the cab, which releases the brake. In order to apply the brake by hand this lever must be pushed in to its fullest extent.

A trip lever of a different kind will be observed towards the rear and at the opposite side of the motor. This is the reverse trip, which alters the direction of travel of the locomotive. It is operated in a similar manner to the brake trip by means of the Brake and Reverse rail, the ramp in this case being moved to the opposite side of the track. The reversing gear may be operated by hand from the lever in the right-hand side of the cab. In doing this it is very important that the lever should be pulled out for forward running, or pushed in for backward running, to its fullest extent. If this is not done the gear wheels will not engage properly and damage is likely to result.

When we have mastered the functions of the two control levers it is advisable to drop a little oil on the various moving parts of the engine before setting it to work. Only a very small quantity is required on each part, as the oil is flung about in the motor by the motion of the gear wheels and spindles. The coupling rod pins and the piston rods should not be overlooked, and it is a good plan to put a drop or two of oil between the plates of the spring in order to ease its action.

When we have assembled the train, pushed in the left-hand or brake lever in the cab, and seen that the reversing or right-hand lever is pulled in or pushed out, depending upon the direction the train is to go, the next step is to wind up the engine. This is best done with the left hand holding the locomotive down on the track and operating the key with the right-hand. Although the Hornby springs are of the highest quality and strength, care should be taken not to over-wind them. With a new engine it is a good plan to wind very gently so as to get used to the feel of the spring when this is approaching the winding limit.

After the engine has been wound up, the brake lever in the cab is released and the train moves off. Perhaps at first the speed will not be as great as was expected, but this is on account of the newness of the mechanism. After a little careful "running-in" the engine will be found capable of higher speeds and longer runs, and of hauling greater loads. There is, of course, a speed limit, as the motors are made in such a manner that the engines are prevented from "racing," and made to maintain a realistic and even speed with a good load, without becoming derailed on curves even when run alone.



Suggested Layouts (No. 8)

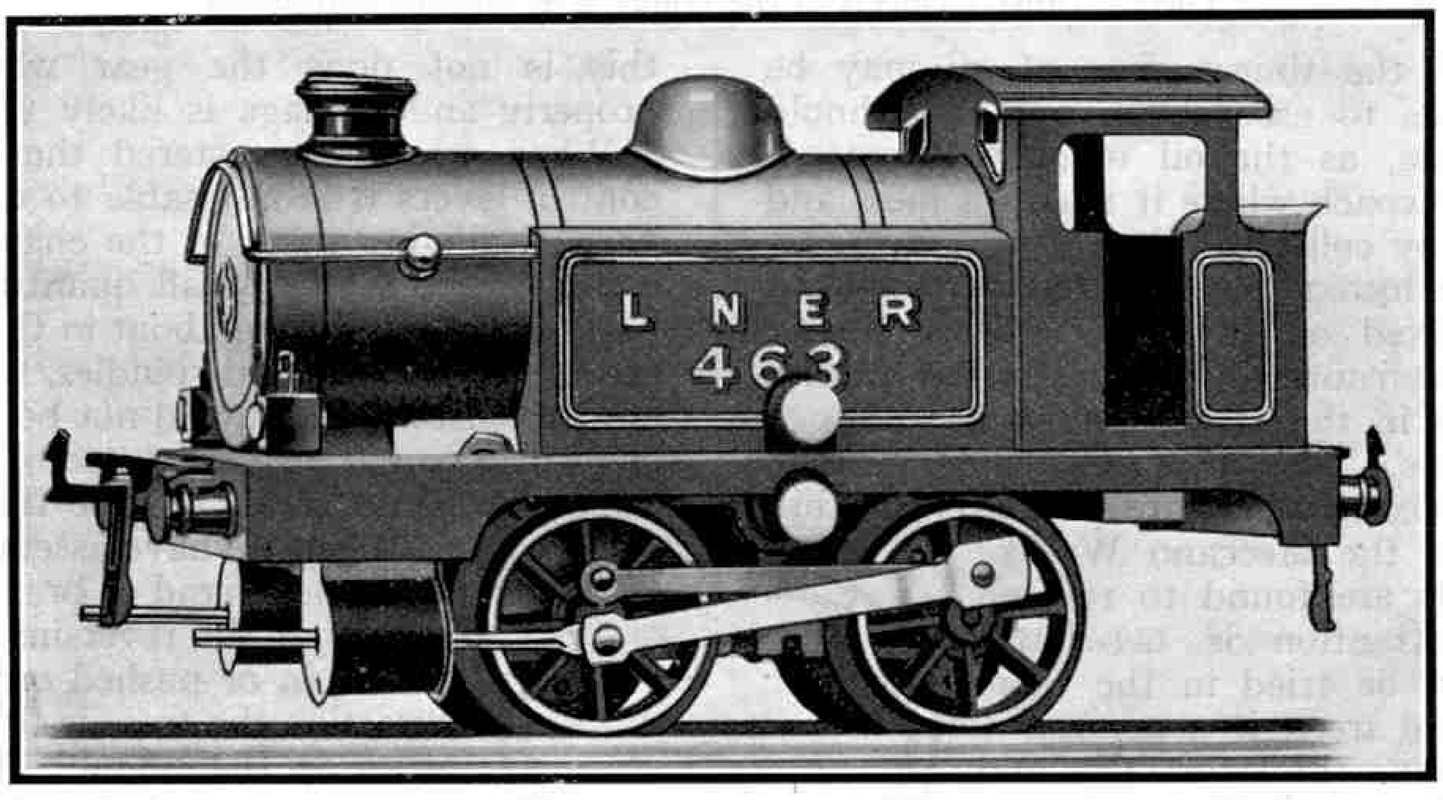
2′ Radius (as illustrated): 22 Curves, 20 Straights, R.H. Points, L.H. Points.

1′ Radius: 10 Curves, 9 Straights, R.H. Points, L.H. Points.

XVI.—HORNBY ELECTRIC LOCOMOTIVES

IN previous articles we have confined ourselves to operations with clockwork locomotives, and we must now turn our attention to the splendid possibilities afforded by the electric locomotives and track included in the Hornby system.

Locomotives for electric railways may be miniatures of those used on real electric railways, or they may be of the steam type fitted with electric mechanism. Both kinds are represented in the Hornby range. For instance, the well-known electric locomotive of the Metropolitan Railway is reproduced in the system. In addition locomotives of the 4–4–2 type may be obtained with electric motors in place of the usual clockwork mechanism. These are the No. 3E locomotives and they offer a very wide choice, for they include representatives of the four British railway groups as well as the locomotive that hauls the well-known replica in the Hornby system of the famous Riviera "Blue" Train.



No. 1 Permanent Magnet Tank Locomotive of the Hornby series. This may be started, stopped and reversed from the track.

The first step to be taken by those who wish to form a model electric railway, whether this is entirely new or is formed from an already existing clockwork layout, is to decide upon the source of current. The motors of the Hornby electric locomotives noted are designed to use current supplied at 6 volts. This may be direct current from a 6-volt accumulator, or alternating current from a step-down transformer connected to electric light mains.

Where alternating electric current is available the use of a transformer is very convenient, but those who are planning an electric railway and wish to use a transformer must note that this can be used only with alternating current mains. The current actually supplied from the Meccano transformer, which is specially designed for use with Hornby trains, has a slightly higher voltage than the direct current from a 6-volt accumulator in order to overcome impedance effects that come into play.

From time to time readers have suggested that direct current mains could be used if a suitable resistance were inserted in the circuit in order to reduce the voltage drop across the terminals of the motors to six. There are several objections to this course and we strongly advise against it. The current that would flow if such an arrangement were made would almost certainly be too heavy, and excessive sparking would take place between the brushes and the commutator of the motor. This would cause blackening and pitting of the latter. Thus the efficiency of the locomotive would be very greatly reduced, and other damage also may result.

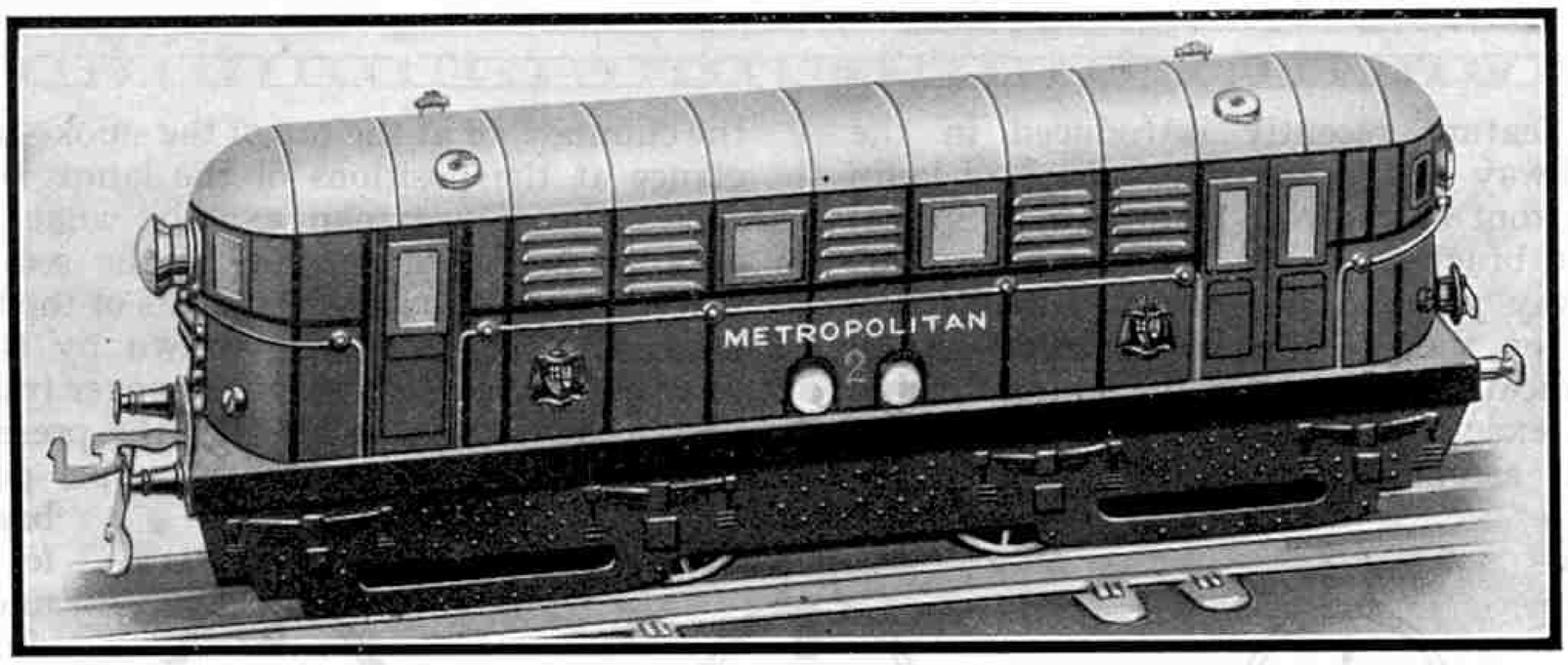
Practically the only alternative to a transformer is a 6-volt accumulator. The electric motors of Hornby trains work as well with direct current from an accumulator as with alternating current from a transformer, and thus the absence of an electric light supply is no obstacle to the formation of an electric layout.

An accumulator needs a certain amount of attention in order to keep it in good order. The amount required is not excessive, however, and if it is examined and charged regularly it forms almost an ideal source of current for a Hornby electric layout. An accumulator used for this purpose should have a discharge rate sufficient to meet the demands made upon it. For this reason the Meccano accumulator undoubtedly is the most suitable, for it has a capacity of 20 amps, and is easily capable of supplying the current required. Accumulators with a slow discharge rate are quite unsuitable for running electric railways.

Although the normal discharge rate of the Meccano accumulator is fairly considerable it must not be exceeded, for in that case damage may be done to its plates and its general performance affected. In particular, short circuits must be avoided. These may arise as the result of derailments, or in some other accidental manner, but trouble due to the sudden heavy flow of current may be prevented by including a simple cut-out in the circuit. A cut-out forms part of the connecting plate by means of which current is supplied to a Hornby electric layout, a

short length of fuse wire being connected between two terminals in the lead to the centre rail. If a short circuit is formed the rush of current causes the length of fuse wire to melt, and thus the accumulator is disconnected from the track before irreparable damage is done.

When the protecting fuse wire melts it is not sufficient merely to replace it by another length —the cause of the short circuit must be found and the trouble eliminated. The first step is to remove the train from the rails, after which a piece of fuse wire should be inserted and the current switched on. If the wire again fuses then the fault must be in the track. It may be found by inspection, but if not, a series of tests should be made. For this purpose a 6-volt flash lamp bulb should be used. As shown in Fig. 1 the lamp 1 should be inserted between the terminals 3 and 4 that normally carry the fuse wire, and because of the existence of a short circuit it will light up when the current is switched on. The rails should then be removed one by one until the light goes out, the last to be removed before this takes place being the one that is defective.



Hornby Metropolitan Electric Locomotive : a reproduction in miniature of the locomotive used on the Metropolitan railway.

In order to obtain good running from a Hornby electric locomotive it is necessary that all connections should be sound and that running contacts should be clean. The rails should be joined carefully and special attention always must be given to the insulation. Rough handling may give rise to very annoying short circuits that may be difficult to trace.

The surfaces of the rails must be kept bright and clean, and should occasionally be wiped down with a paraffin rag, while the shoes by means of which the current is conducted to the motor also must be kept in bright condition. When lubricating the working parts of the locomotive special care must be taken not to use too much oil, for a thin film of this on the contacts will considerably reduce the efficiency of an electric railway.

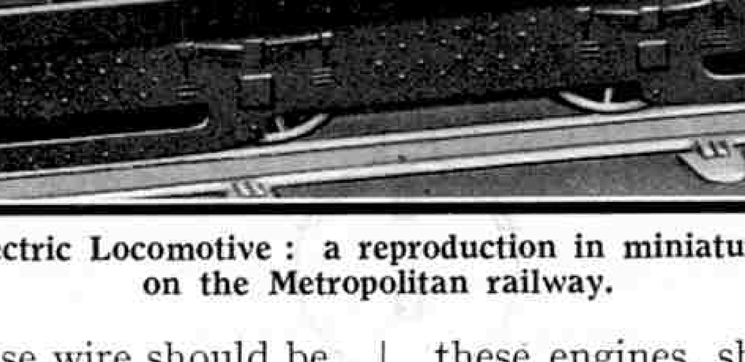


Fig. 1

The various moving parts of the locomotive should be oiled occasionally. Meccano lubricating oil is specially prepared for this purpose and should be applied to the armature shaft, the driving axles and other working parts in sufficient quantity to give them free movement. Any excess of oil is flung in all directions and a dirty locomotive and a dirty track is the result.

The face of the commutator should not be oiled, the brushes that bear upon it by spring pressure being made of a copper-carbon compound that itself contains the necessary lubricant. Should the slots of the commutator become filled up with dirt, they may be cleaned by the gentle use of a pin or a sharpened match-stick.

In order to obtain the best results from a No. 3E or Metropolitan electric locomotive, the brush-holder caps, which may be seen on the right-hand side of these engines, should be tightly screwed up. When an electric locomotive leaves the factory, its brush springs are correctly adjusted. They should not be tampered with, for if the caps are unscrewed at any time, the spring may jump out and be lost. An additional danger is that when the springs are replaced the brush pressures on the two sides of the commutator may be unequal, and this would result in bad running.

It may be found that on portions of the layout remote from the connecting plate an electric train may slow down considerably. The reason for this is the voltage drop due to the resistance of the rails themselves. The remedy is to use a second terminal plate connected by auxiliary feeder wires to the resistance controller.

The purpose of a resistance controller is to enable the speed of the locomotive on the track to be varied. The No. 3E and the Metropolitan locomotive have motors of the wire-wound field type and may be operated either on direct current supplied from an accumulator or on the alternating current obtained from a transformer connected to A.C. electric mains. These locomotives are reversed by means of a lever, which is in the usual position on the No. 3E engines and projects from the housing of the Metropolitan locomotive.

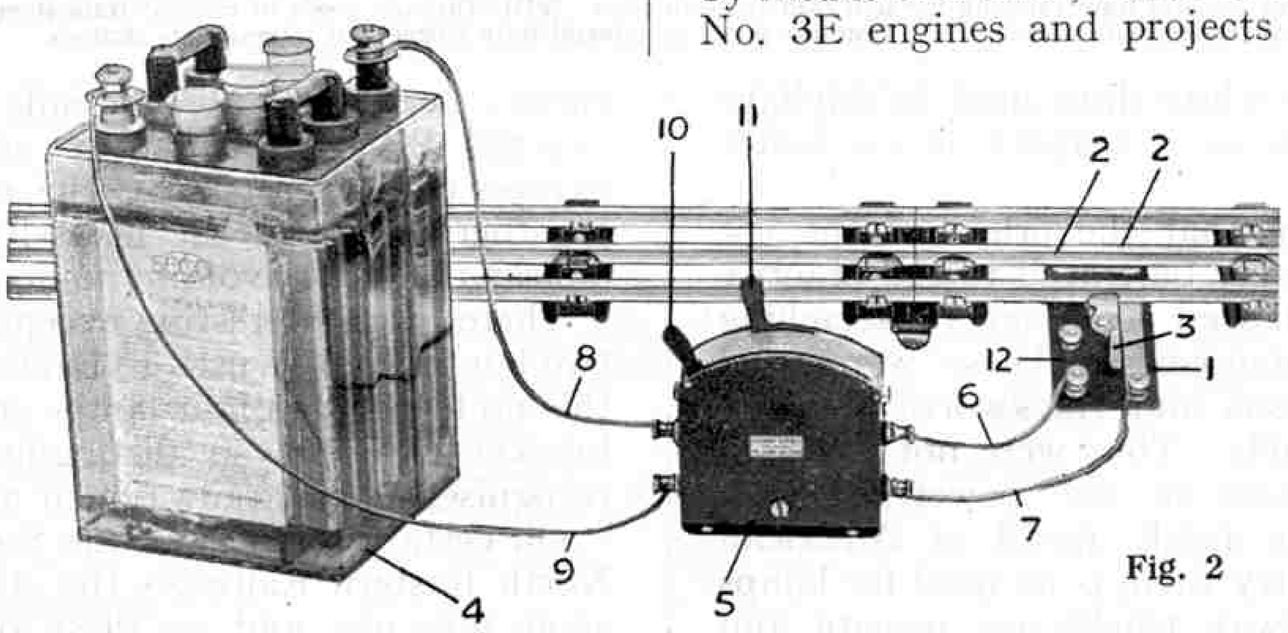


Fig. 2

It is impossible to reverse the electric locomotives already mentioned by changing the direction of the current supplied to them. The reason for this is that current from the same source is supplied to the windings of the armature and the electro-magnet that provides the field. Changing the direction of the current thus reverses the directions both of the lines of force of the magnetic field and of the flow of current through the armature winding.

In order to enable the direction

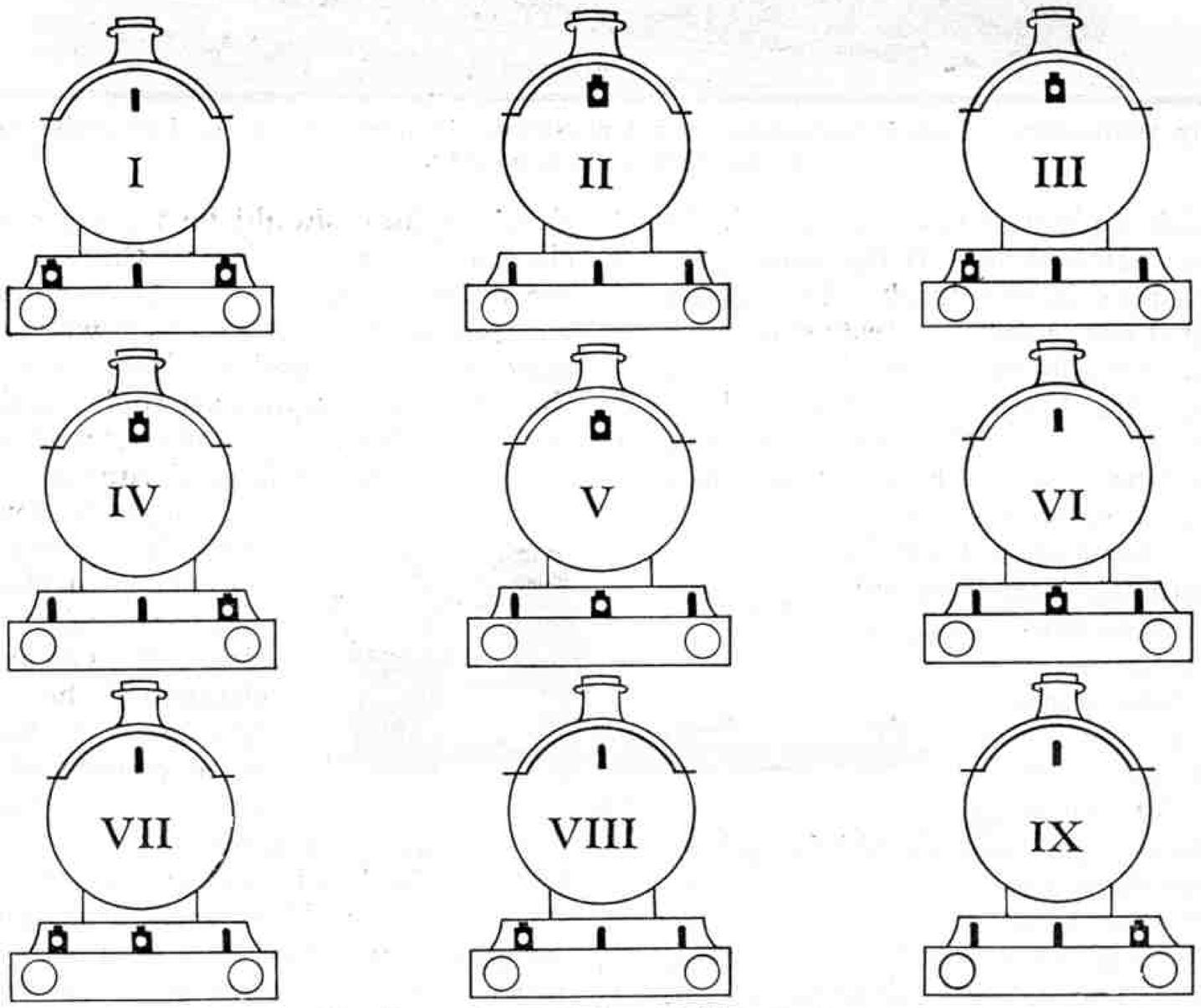
(*Continued on page 162*)

Headlamp Code for Hornby Locomotives

By "Tommy Dodd"

A POPULAR feature recently introduced in the Hornby Railway system is the provision of lamp brackets in front of the No. 1 and No. 2 Special Locomotives. The brackets are in the same positions as in correct railway practice and neat headlamps are provided to place on them. This will enable Hornby train owners to indicate the nature of the trains running on their tracks in exactly the same manner as on real railways, and it is astonishing to find how much the innovation adds to the realistic appearance of a miniature railway system.

In order to make the best use of these headlamps it is necessary to know something of the code in use. To-day a standard scheme is employed on British railway systems, the only exception being found on the Southern Railway, the locomotives of which carry white discs instead of lamps. This practice is followed only during the daytime, and at night the class of train drawn by a Southern Railway locomotive is shown by the arrangement of lamps carried exactly as on other British railways. In any case the code followed is the same, for the white discs used in daylight are arranged in exactly the same manner as the lamps employed on other lines.



Headlamp Code used on British Railways.

I. Express passenger train. II. Ordinary passenger train. III. Train composed of coaching stock carrying livestock, or perishable goods. IV. Fish, meat, or fruit train composed of goods stock, or express cattle or goods train, Class A. V. Express cattle or goods train, Class B. VI. Light engine or engine and brake only. VII. Goods or mineral train carrying through load to destination. VIII. Through goods or mineral train stopping at intermediate stations. IX. Ordinary goods or mineral train stopping at intermediate stations.

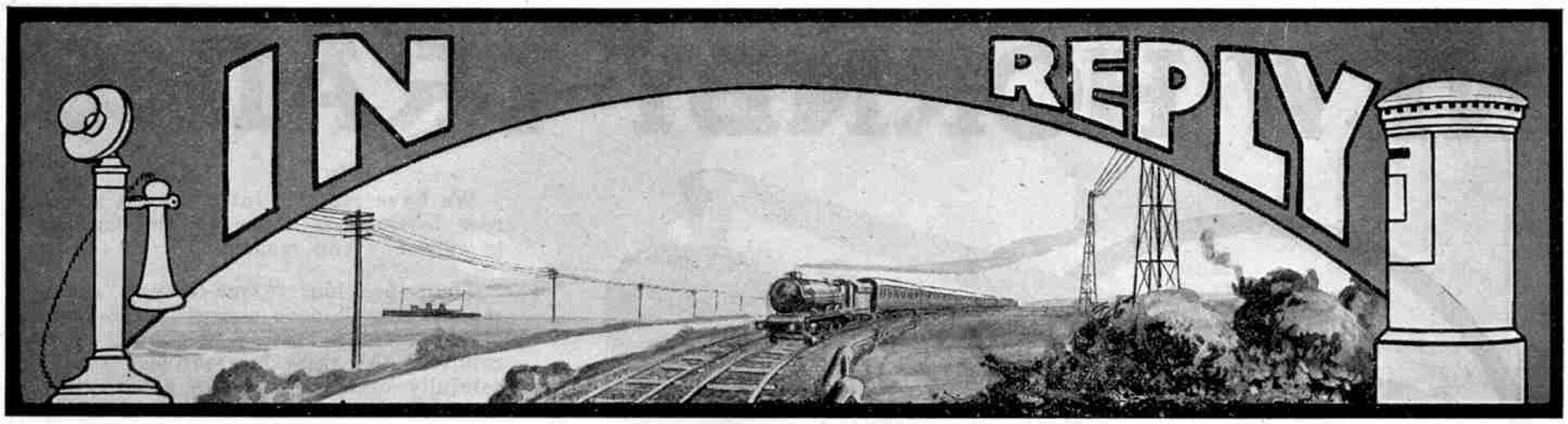
It is interesting to learn that the origin of the use of lamps for this purpose may be traced to the practice followed more than one hundred years ago of attaching to trains cressets of burning coals. These were used on the engines of Stephenson and Hackworth in order to give warning of approach. They were not intended to serve the same purpose as the powerful headlamps that illuminate the track ahead of American locomotives. In this country there is no need for lamps of this kind, for our railway tracks are private and protected by fences, and the smaller lamps that may be seen from a distance are merely used to enable railwaymen to recognise the character of an approaching train.

The brackets on the Hornby Special locomotives are four in number, exactly as on real engines, three being placed on the buffer beam and one at the base of the chimney, or at the top of the smoke-box door. A mere glance at the positions of the lamps on these brackets shows the railwayman exactly what kind of train is approaching. For instance, if he sees that lamps are placed on the outermost brackets of the buffer beam only, he knows that the train drawn by the locomotive so distinguished is an express passenger train. An ordinary passenger train is marked by the presence of one lamp only, this being placed in the upper position, the three brackets on the buffer beam being left unoccupied. In a similar manner different classes of goods trains may be distinguished by the use of one or two lamps placed in various positions. The diagram on this page gives the arrangement of lamps according to the standard code, which was introduced as recently as 1918. In this no more than two lamps are employed and these must show white lights.

It is important to note that one arrangement of headlights may indicate two or more classes of trains. For instance, a breakdown train or a light engine going to the assistance of a disabled train carries headlights at the ends of the buffer beam in exactly the same manner as the locomotive of an express passenger train. The reason for grouping these together is clearly the necessity for giving such trains a clear road and avoiding unnecessary delays.

There is an interesting exception to the rule that only two lamps shall be used to indicate the class of train. In this no fewer than four lamps are employed, one on each bracket—a train so distinguished being immediately recognised by all railwaymen as a Royal Train.

On certain sections of the Southern and London and North Eastern Railways the standard code has not yet come into use, and on these special codes are used to indicate the routes or destinations of trains. In these cases the reason for the use of special codes is the large number of alternative routes available. No doubt other means will be found of showing the route followed by a train and then the standard code probably will come into operation on these sections also.



Suggested Hornby Train Improvements

STATION LORRIES.—Miniature motor lorries such as you suggest could, no doubt, be used effectively in conjunction with a layout. We cannot undertake to manufacture vehicles of this nature, however, and we suggest that you build models to suit your requirements out of standard Meccano parts. (*Reply to R. T. Jessop, Willesden*).

"PRINCE OF WALES" CLASS LOCOMOTIVE.—We agree that this interesting and useful type of locomotive would be simple to manufacture on account of the housing being so very plain. Its introduction would necessitate the use of a six-coupled mechanism, however, which we do not propose to introduce at present. (*Reply to F. G. Cooper, Manchester*).

MINIATURE RAILWAY STAFF.—We have had very many requests for miniature drivers, firemen, porters, passengers, etc., for station use, and, as we have previously stated, we have the matter under consideration. (*Reply to L. Hoey, Prescot; G. Thomas, Wrexham; and others*).

SPRING DRAW-BARS.—Your suggestion for spring draw-bars for the front of Hornby No. 2 Special locomotives is interesting and will have consideration. We shall also consider your proposal that spring draw-bars should be fitted to our No. 2-3 Pullman cars, and we agree that this addition would ease the locomotive effort required to set the cars in motion. (*Reply to T. Denton, Liverpool*).

J.39 CLASS LOCOMOTIVE.—This goods locomotive appears to be very popular among L.N.E.R. enthusiasts, and we have no doubt that a model would be welcomed. We are therefore filing the idea for consideration. (*Reply to E. Tudor, Birmingham*).

COLOUR LIGHT SIGNALS.—The drawings you have sent showing the many realistic operations that can be carried out with the use of colour light signalling, such as a train stopping before a red light and proceeding when the light shows green, are very interesting indeed. We think there are possibilities in the idea and we shall give it consideration. (*Reply to T. Clayton, Bury*).

POINTS LEVER TO OPERATE PARALLEL TO TRACK.—This suggestion is quite interesting. We quite agree that such an arrangement would save a great deal of space, and such points could be used with the double track without the lever having to be fitted on the inside of the curve as is necessary at present. The idea is also in accordance with actual railway practice. This suggestion will be given very careful consideration. (*Reply to T. Murray, Dublin*).

SEPARATE PARTS FOR TERMINAL STATION.—A terminal station built up from separate parts would, no doubt, look very well when finished, but we are afraid that the number of parts required would be too great. The price of such sets of parts would necessarily be high, and we do not think the idea would be popular. (*Reply to W. Pollock, Scarborough*).

MINIATURE ROYAL TRAIN.—The Royal Train is not used sufficiently often to justify our introducing a miniature reproduction. Our new locomotives are fitted with four lamp brackets, and a Royal Train may be made up quite easily out of the present range of stock, using the correct headlamp code. (*Reply to E. Weaver, St. Helens*).

RED TAIL LAMPS.—We shall consider your idea for red tail lamps as we agree that it would be easy to colour the bulb red instead of white. (*Reply to P. Pearson, Burnley*).

"TRUE-TO-TYPE" L.N.E.R. "ATLANTIC" LOCOMOTIVE.—We were interested in your suggestion for the introduction of one of the famous L.N.E.R. (G.N.) "Atlantics" into the Hornby Series. The L.N.E.R. is the chief user of "Atlantic" type locomotives, and we should have no corresponding model to offer enthusiasts who favour the other companies. For the same reason we are unlikely to introduce a "Director" of the same railway, although we fully understand your warm admiration of both these classes of locomotive. (*Reply to R. F. London, Warwick*).

CURVED BRAKE AND REVERSE RAIL.—We realise the advantages that would follow the fitting of brake and reverse apparatus to a curved section of rail, in addition to the present straight rail, and we will therefore bear your idea in mind. (*Reply to E. Blythe, Newcastle*).

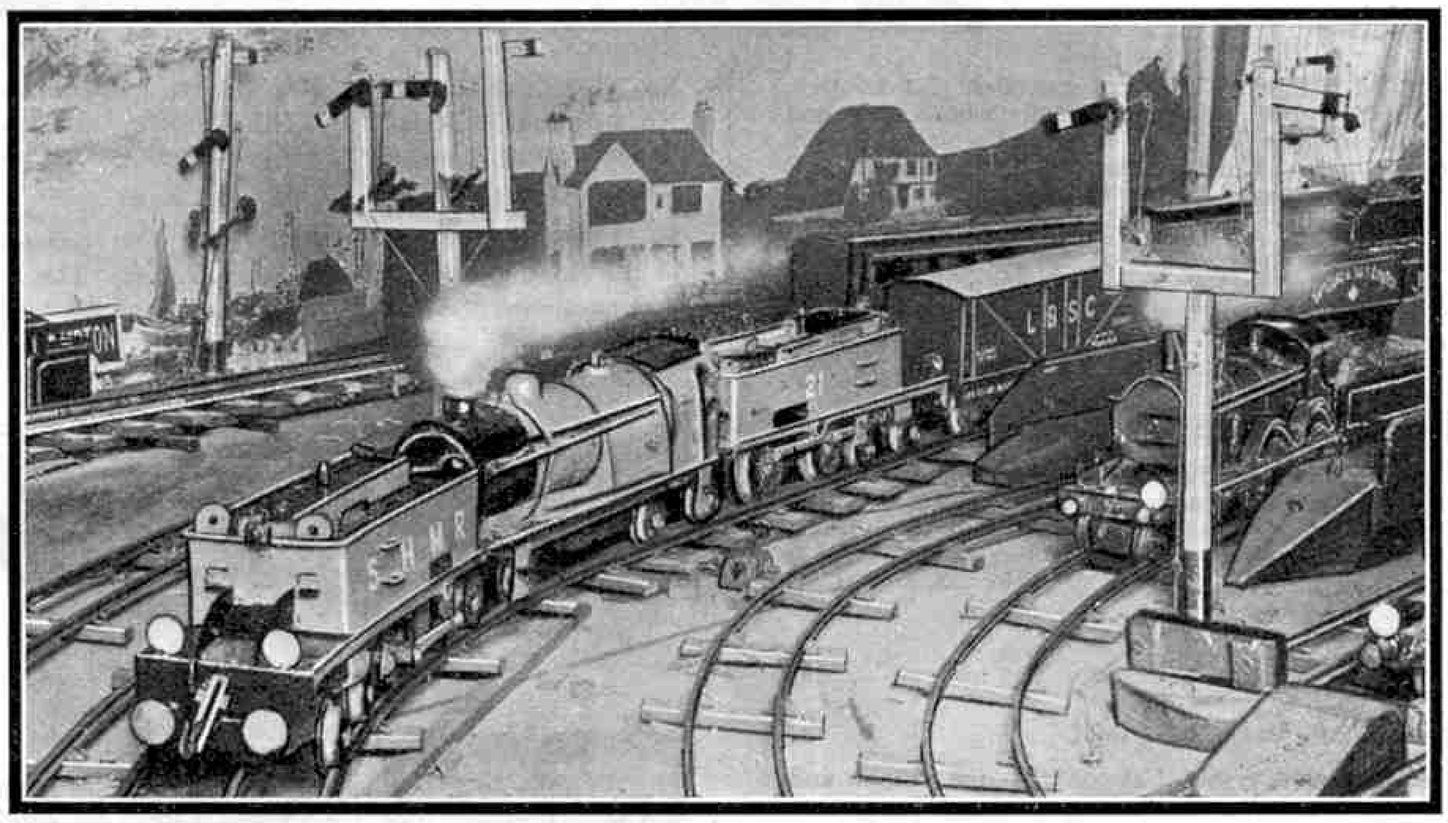
CORRIDOR TENDER.—L.N.E.R. "Pacifics" are the only locomotives at present running with corridor tenders, and we do not propose to include such vehicles in the Hornby Series as we do not make a suitable engine. One of these tenders fitted to our present "Shire" locomotives would appear entirely out of proportion. (*Reply to R. Hawthorn, Coventry*).

AEROPLANE VAN.—We do not think that such vans as you suggest are in sufficiently common use to warrant their introduction into the Hornby Series. Our standard No. 2 Luggage Van approximates closely to the van you describe. (*Reply to H. Duffield, Putney*).

SLEEPER-BUILT DEAD-END BUFFER-STOP.—We note that you require a dead-end buffer-stop such as is used in country districts. We have had little demand for them and they would not be as efficient as the present Hornby types of buffers. (*Reply to K. Hepworth, Leeds*).

IMPROVED LUMBER WAGONS.—We have carefully noted your suggestion that No. 1 Lumber Wagons should be fitted with bolsters and central couplers to enable them to be joined in pairs. As this practice is common in actual railway working, it would no doubt be popular with Hornby train owners. (*Reply to F. Foster, Stalybridge*).

CAST PLATFORM LUGGAGE.—Your suggestion that our present milk cans and miniature luggage should be made heavier and slightly smaller is extremely interesting, and we shall carefully consider the idea. (*Reply to J. Scott, Preston*).



A "Garratt" type locomotive on a down goods train between Haywards Heath and Brighton stations on the miniature railway of W. R. S. Smart, Harrow (H.R.C. No. 1502). This interesting model was built by our reader.

ELECTRIC MOTORS FOR No. 2 SPECIAL LOCOMOTIVES.—At present we do not propose to fit our No. 2 Special locomotives with permanent magnet motors. We agree that if the locomotives were so fitted they could be operated without being touched by hand, which is certainly an advantage. (*Reply to R. Nestor, Blackheath*).

G.W.R. 2-6-0 LOCOMOTIVE.—We are interested in your suggestion that the housing of our new "*County of Bedford*" should be converted into a 2–6–0 "Mogul" by utilising the Hornby Pony Truck for the front bogie and a new six-coupled mechanism. We are at present experimenting on somewhat similar lines and when definite results are reached an announcement will be made in the "*M.M.*" (*Reply to B. Oxton, London, S.W.17*).

SCALE SIGNALS.—Scale signals such as you propose would be very effective, but they would involve very costly alterations to our present range. Your idea will be borne in mind, however, when next we revise our accessories. (*Reply to H. Telpher, Wallasey*).

STATION CLOCK.—A station clock would not serve any useful purpose and would be purely ornamental. For this reason we do not think the introduction of such an accessory would meet with approval. (*Reply to N. Corlett, Newcastle*).

H.R.C. CORRESPONDENCE PADS.—We have had many suggestions for H.R.C. correspondence pads similar to those used in connection with the Meccano Guild. We have this matter under consideration and hope to make an announcement before long. (*Reply to A. Baker, Wolverhampton; C. Shaw, Halifax; H. Elliot, Southampton; and others*).

G.W.R. "BULLDOG" CLASS LOCOMOTIVE.—Quite apart from the high cost of manufacture on account of the outside frame and cranks, we do not think such a locomotive would prove very popular. At any rate we have had no requests for its introduction to the Hornby Railway System. (*Reply to J. H. Terry, Goodwick, South Wales*).

LARGER TURNTABLE WITH HAND RAILS.—For the time being we do not propose to manufacture a larger turntable, but we may do so later. Hand rails would certainly add to the realism of this accessory. (*Reply to P. Webb, Garston*).

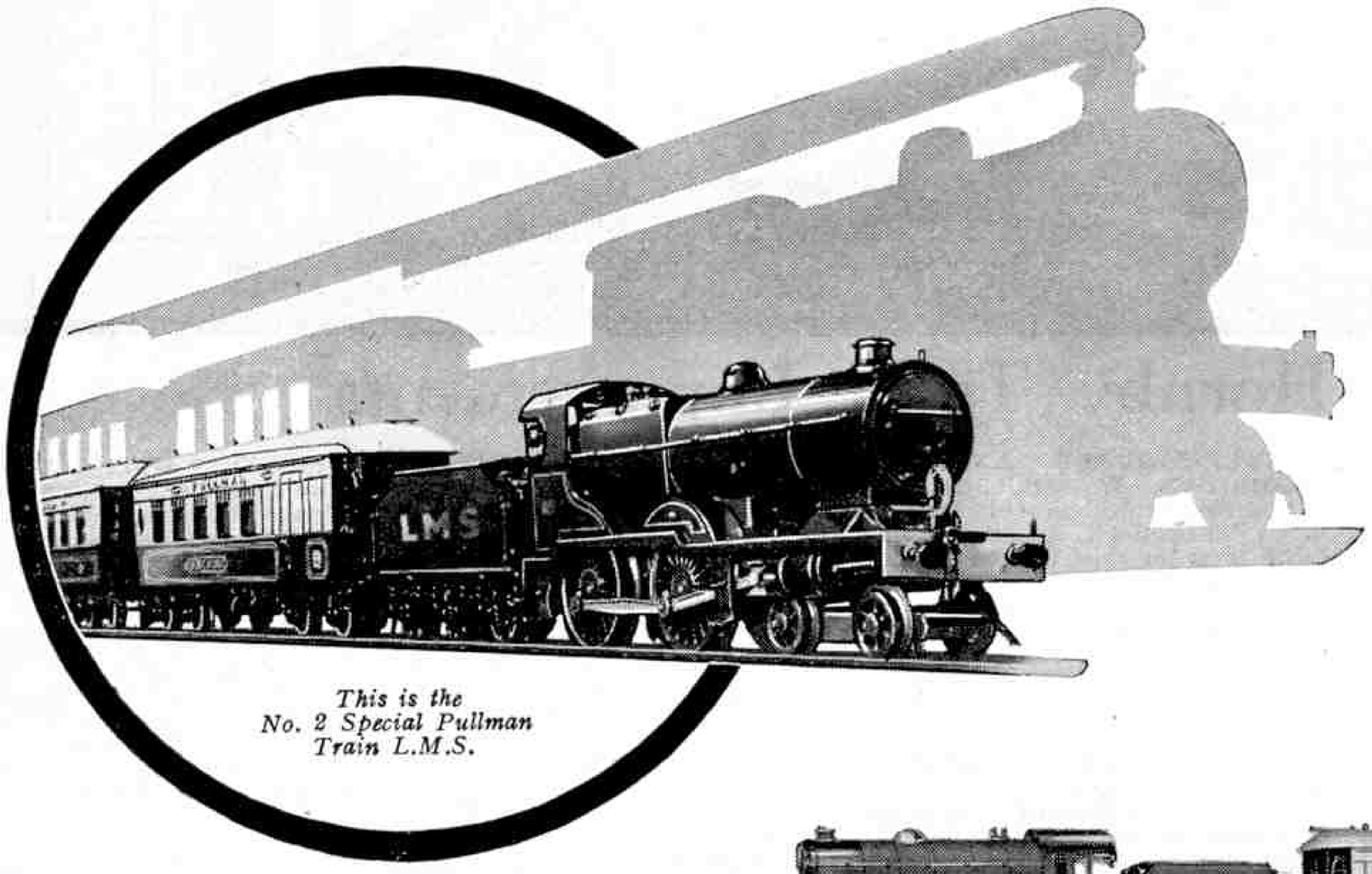
TAIL LAMP BRACKETS ON COMPOSITE COACHES.—The proposal to place lamp brackets on Pullman composite coaches and the rear of goods brake vans is already receiving our attention. We hope shortly to arrive at a definite decision. (*Reply to R. Douglas, Sutton*).

IMPROVED LAMP STANDARDS.—We note your suggestion that an improved type of single lamp standard complete with bulb should be introduced into the Hornby System, and will keep your idea in mind when re-designing this accessory. (*Reply to T. White, Durham*).

LARGER SIGNAL CABIN.—There appears to be very little demand for a larger signal cabin, and we are rather doubtful whether such an accessory would be worth the cost. Why not use two lever frames? (*Reply to W. Morgan, Rhyl*).

ELECTRICAL CROSSOVER.—An electrical crossover would prove a popular addition to the Hornby series and the idea will receive careful consideration at the earliest opportunity. (*Reply to F. Lamb, Stockport*).

NEW HORNBY TRAINS



This is the No. 2 Special Pullman Train L.M.S.

We have recently introduced a series of new locomotives that are the last word in efficiency and realism.

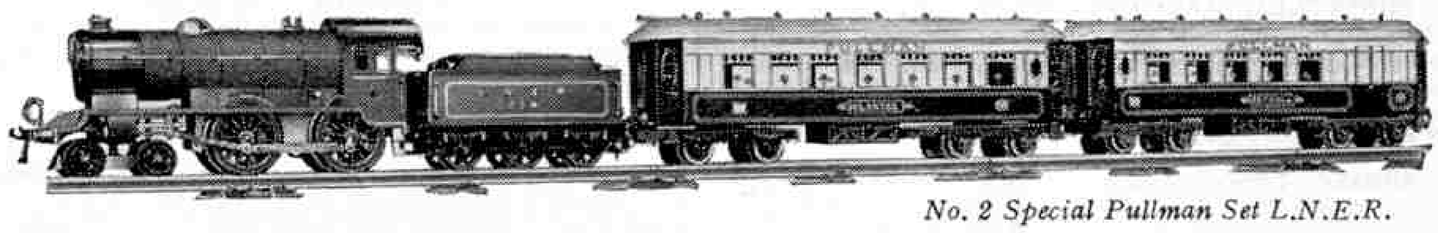
There are four "true-to-type" models representing famous classes in the services of the leading railway companies in this country. All these locomotives have been carefully designed and are fitted with an entirely new mechanism that gives great length of run and exceptional pulling power.

In addition there are splendid new Tank and Tender Locomotives that are realistically designed and beautifully finished in correct colours. These locomotives, too, are all fitted with greatly improved mechanisms that give longer runs and make possible bigger loads.

Full details of the new Hornby Trains are given below. Ask your dealer to show you specimens.

No. 2 Special Pullman Sets

"True-to-type" Models



No. 2 Special Pullman Set L.N.E.R.

No. 2 SPECIAL PULLMAN SET, L.N.E.R. This set contains Locomotive, Tender, No. 2-3 Pullman Coach, No. 2-3 Pullman Coach Composite and set of Rails, including a Brake and Reverse Rail, by means of which the train may be braked or reversed from the track. The Locomotive, which is enamelled in green, is named "Yorkshire," and is a model of the famous "Shire" class. Price **55/-**

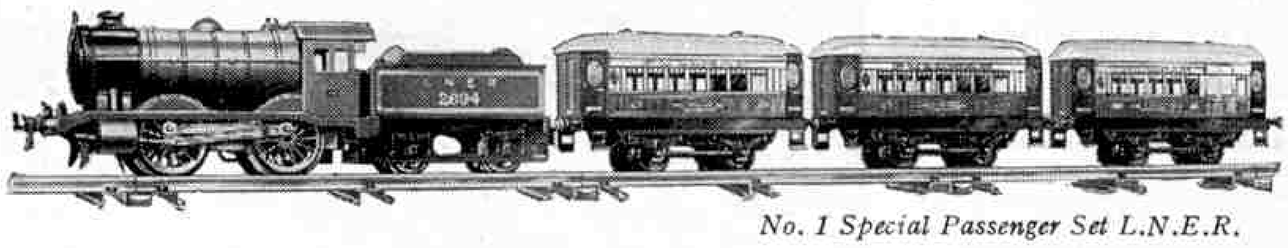
No. 2 SPECIAL PULLMAN SET, L.M.S.R. The contents of this set are as those of the No. 2 Special Pullman Set, L.N.E.R. The Locomotive is enamelled in dark red and numbered "1185." It is a model of the L.M.S. "Standard Compound" class locomotives, which are not named ... ... Price **55/-**

No. 2 SPECIAL PULLMAN SET, G.W.R. The contents of this set are as those of the No. 2 Special Pullman Set, L.N.E.R. The Locomotive, which is enamelled in Great Western green, is named "County of Bedford." It is a model of the famous "County" class ... ... Price **55/-**

No. 2 SPECIAL PULLMAN SET, S.R. The contents of this set are similar to those of the No. 2 Special Pullman Set, L.N.E.R. The Locomotive is enamelled in green and numbered "A.759." It is a model of the new "L" class locomotives, which are not named ... ... Price **55/-**

No. 1 Special Passenger Set

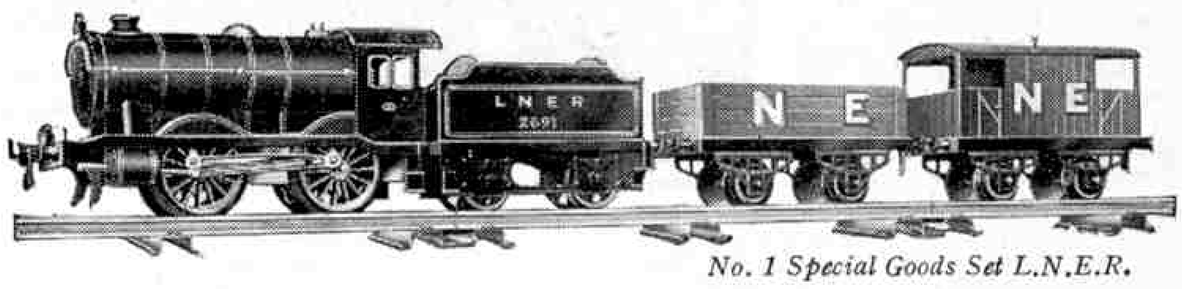
The No. 1 Special Passenger Set contains Locomotive, Tender, two No. 1 Pullman Coaches, one No. 1 Pullman Coach Composite and set of Rails, including a Brake and Reverse Rail, which enables the Locomotive to be braked or reversed from the track. The doors of the coaches open. Gauge 0 ... ... Price **32/6**



No. 1 Special Passenger Set L.N.E.R.

No. 1 Special Goods Set

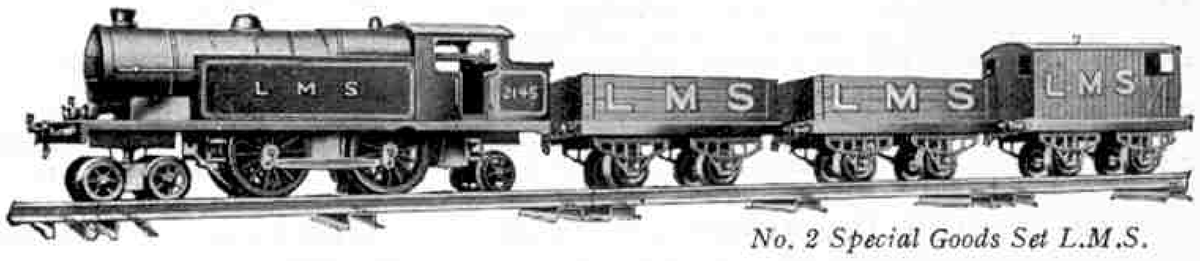
This set is similar to the No. 1 Special Passenger Set, but contains one Wagon and one Brake Van in place of the Pullman Coaches. The Locomotive and Tender are supplied in the regulation goods traffic colours—black for L.N.E.R., L.M.S.R. and S.R., and dark green for G.W.R. If required, the set may be obtained with the Locomotive and Tender in passenger train colours—green for L.N.E.R., red for L.M.S.R., and dark green for G.W.R. and S.R. Gauge 0 ... ... Price **30/-**



No. 1 Special Goods Set L.N.E.R.

No. 2 Special Goods Set

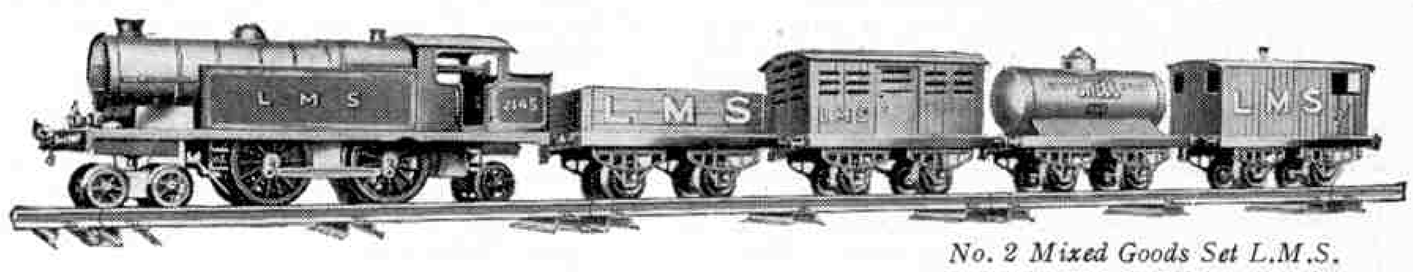
This handsome clockwork Train Set is most realistic in appearance. It is beautifully designed and finished, and is hauled by a fine 4–4–2 Tank Locomotive of great power and speed. Each set contains No. 2 Special Tank Locomotive, two Hornby No. 1 Wagons, Brake Van and set of Rails, including a Brake and Reverse Rail, by means of which the Locomotive may be braked or reversed from the track. The Locomotive is supplied in the regulation goods traffic colours—black for L.N.E.R., L.M.S.R. and S.R., and dark green for G.W.R. If required, the set may be obtained with Locomotive in passenger train colours—green for L.N.E.R., red for L.M.S.R., and dark green for G.W.R. and S.R. Gauge 0 ... Price **35/-**



No. 2 Special Goods Set L.M.S.

No. 2 Mixed Goods Set

This realistic Goods Train consists of the new 4–4–2 Tank Locomotive, as supplied with No. 2 Special Goods Set, Hornby Wagon No. 1, No. 1 Cattle Truck, Petrol Tank Wagon, Brake Van and set of Rails, including a Brake and Reverse Rail, by means of which the Locomotive may be braked or reversed from the track. The Locomotive is supplied in the regulation goods traffic colours—black for L.N.E.R., L.M.S.R. and S.R., and dark green for G.W.R. If required, the set may be obtained with Locomotive in passenger train colours—green for L.N.E.R., red for L.M.S.R., and dark green for G.W.R. and S.R. Gauge 0 ... ... Price **37/6**



No. 2 Mixed Goods Set L.M.S.

Manufactured by MECCANO LIMITED OLD SWAN LIVERPOOL

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

Hornby Railway Company

Have *You* Joined Yet?

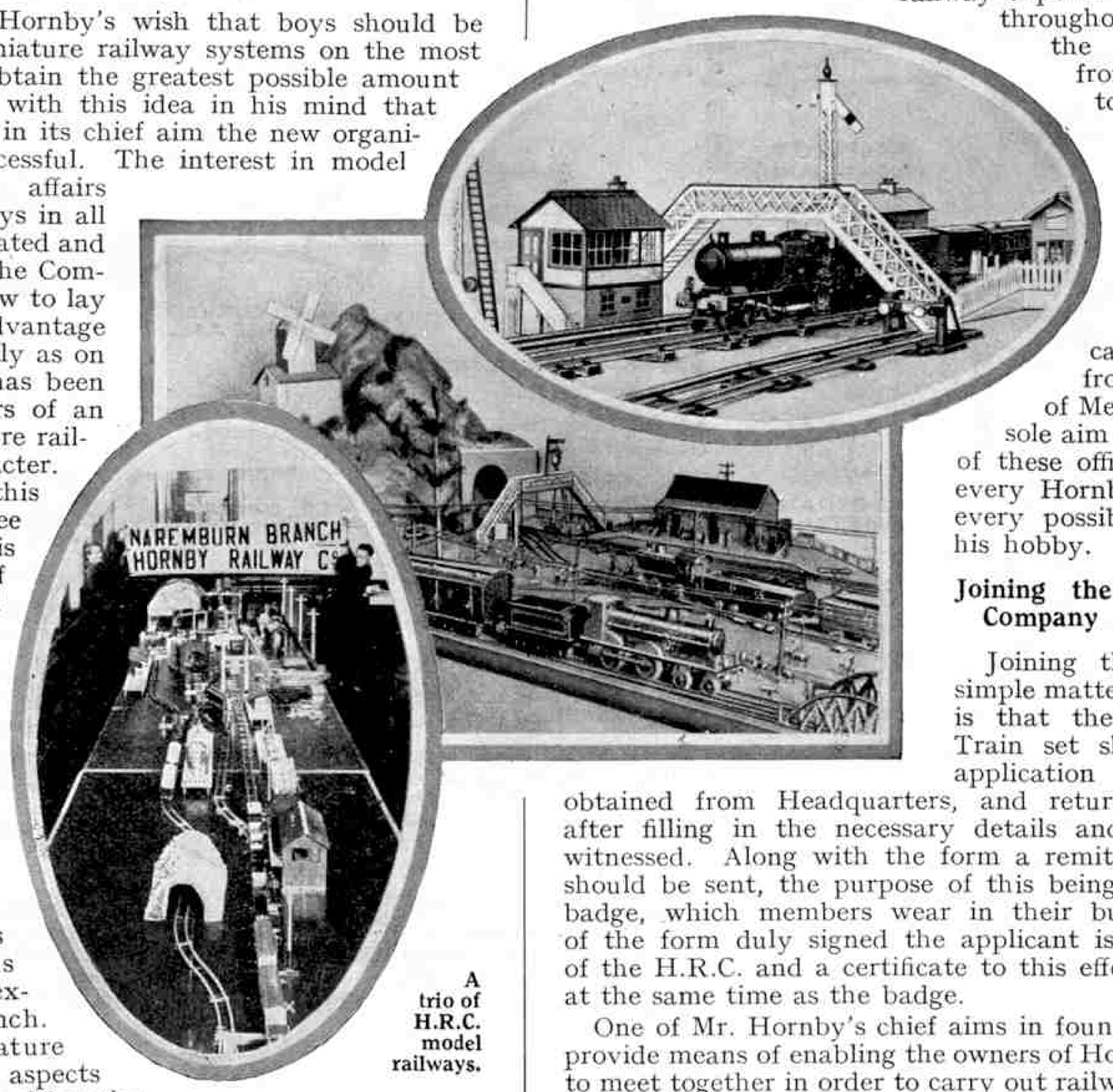
MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

THE Hornby Railway Company is an organisation that has been formed for the purpose of looking after the interests of Hornby Train owners, and enabling them to get as much fun as possible from their miniature railways. It was formed as recently as October 1928, but its membership has grown by leaps and bounds until to-day it approaches 12,000.

The founder and Chairman of the Hornby Railway Company is Mr. Frank Hornby, the inventor of Meccano and Managing Director of Meccano Limited.

The Greatest Fun from your Miniature Railways

It has always been Mr. Hornby's wish that boys should be encouraged to run their miniature railway systems on the most correct lines, and thus to obtain the greatest possible amount of fun from them. It was with this idea in his mind that the H.R.C. was formed and in its chief aim the new organisation was immediately successful. The interest in model railways and in railway affairs generally of thousands of boys in all parts of the world was stimulated and sustained by the advent of the Company. They were shown how to lay out their track to the best advantage and to run their trains exactly as on real railways. The result has been the building up by members of an enormous number of miniature railways of outstanding character. The great possibilities in this direction are shown by the three illustrations that appear on this page, which are sections of actual photographs of model railways owned by members of the H.R.C.



A trio of H.R.C. model railways.

The official organ of the "Hornby Railway Company" is the "*Meccano Magazine.*" A special section of the Magazine is devoted entirely to the affairs of the Company. Brief reports are given of the progress of each affiliated Branch, with special reference to any developments of unusual interest, and thus each Branch benefits by the experience of every other Branch. In addition, articles on miniature railway working in all its aspects appear regularly in pages of the Magazine that are specially devoted to Hornby Railway Company affairs, and every issue of the "*M.M.*" contains articles and notes that will appeal strongly to every railway enthusiast.

The Hornby Railway Company Booklets

Two special booklets have been prepared in connection with the H.R.C. The first of these is known as the "H.R.C. Junior Section" booklet. In it beginners are shown how to commence operations, and how they may obtain as much fun as possible from their hobby by running trains in exactly the same manner as on real railways. The topics dealt with include the laying down of a track, keeping locomotives and rolling stock in good running order, and the development of interesting layouts. This booklet is forwarded to every Junior member of the H.R.C. on enrolment. It may also be obtained on direct application to the Headquarters of the H.R.C.

The second of the two booklets—the "Hornby Railway Company Booklet"—is a more advanced publication that deals with the planning, laying out and operating of a miniature railway on real railway-like principles. One of the most fascinating branches is timetable working, and this receives special attention in the booklet, instructions being given that will enable a timetable to be worked out for any layout. A copy of this booklet is supplied to every member of the H.R.C., and others interested in miniature railway work may obtain the booklet on forwarding 2d. in stamps to headquarters.

The H.R.C. has its headquarters at Binns Road, Old Swan, Liverpool, and the Chairman is assisted by a large and competent staff. The Secretary of the Company is in continual touch with individual members, and is always ready to assist and advise the officials of the 250 local Branches that have been formed in different parts of the world. In addition, a complete staff of competent railway experts is continuously engaged throughout the day in answering the many queries received from members on railway topics of all kinds and in explaining to them how they may improve their layouts or make the working of their systems more interesting and railway-like. These activities of the Hornby Railway Company are carried on quite separately from the commercial side of Meccano Limited, and the sole aim and object of every one of these officials is to ensure that every Hornby train user is getting every possible ounce of fun from his hobby.

Joining the Hornby Railway Company

Joining the H.R.C. is quite a simple matter. All that is necessary is that the owner of a Hornby Train set shall fill in the official application form, which may be obtained from Headquarters, and return it to the Secretary after filling in the necessary details and having his signature witnessed. Along with the form a remittance of 6d. in stamps should be sent, the purpose of this being to pay for the official badge, which members wear in their buttonholes. On receipt of the form duly signed the applicant is enrolled as a member of the H.R.C. and a certificate to this effect is forwarded to him at the same time as the badge.

One of Mr. Hornby's chief aims in founding the H.R.C. was to provide means of enabling the owners of Hornby miniature railways to meet together in order to carry out railway operations of a more interesting character than are possible for a single individual. Consequently the new organisation was planned in such a manner that local Branches could be formed under its auspices.

A local Branch may be formed in any district and may consist of any number of members. The manner in which it is carried on is decided by the members themselves, who appoint or elect officials from their own number. Where the membership is not less than six, in addition to a permanent Branch Chairman and Secretary, and meetings are being held regularly, application may be made for incorporation with the parent company. A special form is provided for this purpose. Copies of it may be obtained from Headquarters, and on receipt of this, the application is placed before Mr. Hornby, Chairman of the H.R.C. for his approval.

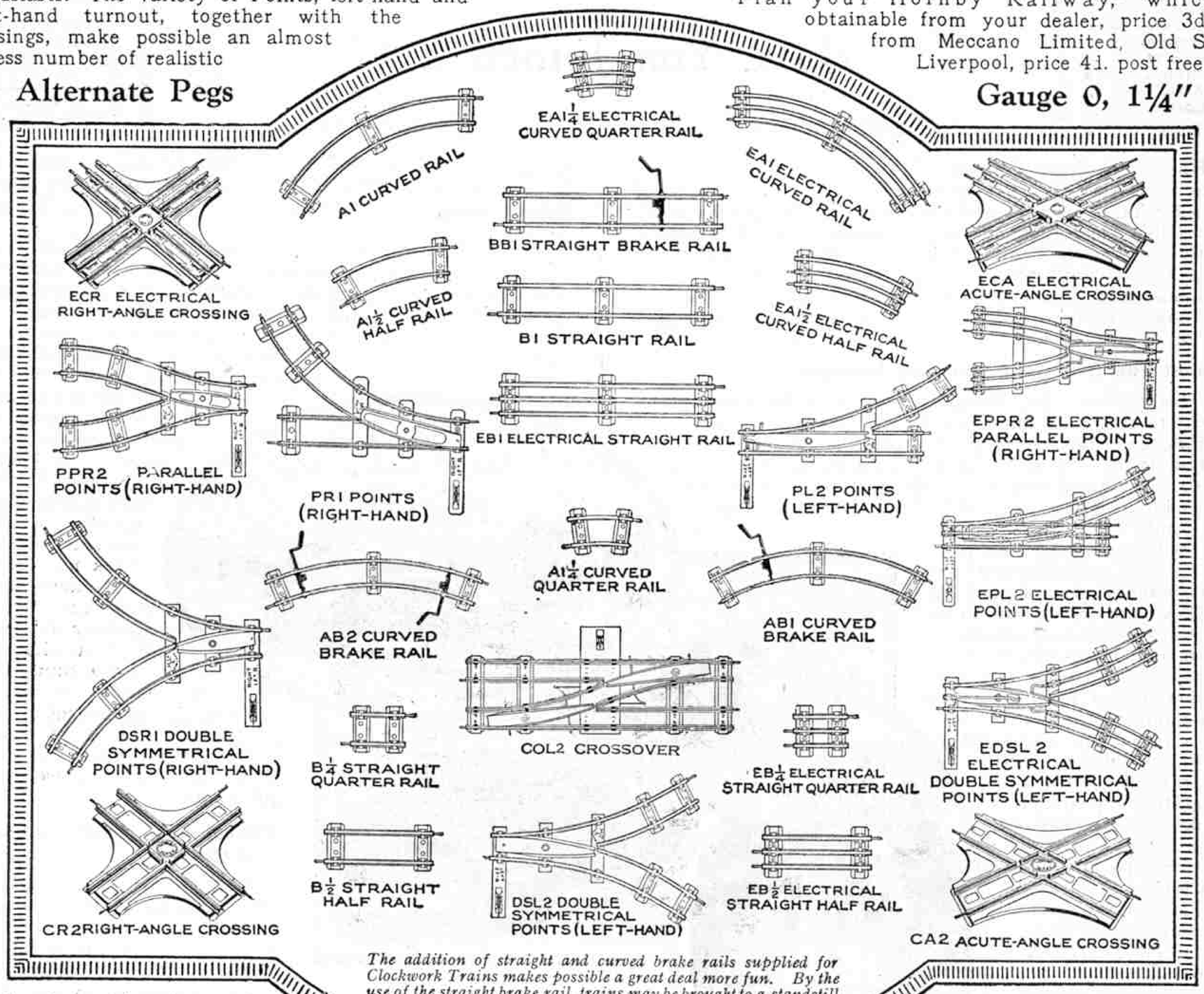
Fulfilment of the necessary simple conditions for incorporation entitle a Branch to many privileges. The necessary instructions for operating a miniature railway system are supplied and advice given regarding the best means of making the most of the material at Branches' disposal. All the necessary forms and documents for successful railway working may be purchased from Headquarters at a small cost. These are miniatures of those actually employed by the big railway companies.

Hornby Series -:- Rails, Points and Crossings -:- Hornby Series

Hornby Rails, Points and Crossings are designed to meet the most exacting requirements of model railway enthusiasts. The variety of Points, left-hand and right-hand turnout, together with the Crossings, make possible an almost endless number of realistic and railway-like layouts. The adaptability of the Rails, Points and Crossings is well shown in a special booklet "How to Plan your Hornby Railway," which is obtainable from your dealer, price 3d., or from Meccano Limited, Old Swan, Liverpool, price 4d. post free.

Alternate Pegs

Gauge 0, 1¼"



The addition of straight and curved brake rails supplied for Clockwork Trains makes possible a great deal more fun. By the use of the straight brake rail, trains may be brought to a standstill at the station platform in a very realistic manner.

Rails for Clockwork and Steam Trains

CURVED RAILS

1-ft. radius

A1	Curved rails	per doz.	4/6
A1½	Curved half rails	„	3/6
A1¼	Curved quarter rails	„	3/-
AB1	Curved brake rails	each	6d.

2-ft. radius

A2	Curved rails	per doz.	4/6
A2½	Curved half rails	„	3/6
A2¼	Curved quarter rails	„	3/-
AB2	Curved brake rails	each	6d.
DC2	Curved rails, double track ...	½ doz.	5/-

DOUBLE SYMMETRICAL POINTS

For 1-ft. radius curves

DSR1	Double symmetrical points, right	per pair	5/-
DSL1	Double symmetrical points, left		

For 2-ft. radius curves

DSR2	Double symmetrical points, right	per pair	5/-
DSL2	Double symmetrical points, left		

PARALLEL POINTS

PPR2	Parallel points, right	per pair	5/-
PPL2	Parallel points, left		

CROSSINGS AND CROSSOVERS

CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	1/6
CA2	Acute-angle crossings (for 2-ft. radius tracks)	„	1/6
CR1	Right-angle crossings (for 1-ft. radius tracks)	„	1/6
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/6
COR2	Crossovers, right hand ...	per pair	12/-
COL2	Crossovers, left hand ...		

POINTS

For 1-ft. radius curves

PR1	Right-hand points	per pair	4/-
PL1	Left-hand points		

For 2-ft. radius curves

PR2	Right-hand points	per pair	4/-
PL2	Left-hand points		
PSR2	Points on solid base with ground disc and lamp, and adapted for Hornby Control, right ...	per pair	7/6
PSL2	Points on solid base with ground disc and lamp, and adapted for Hornby Control, left ...		

STRAIGHT RAILS

B1	Straight rails	per doz.	4/-
B½	Straight half rails	„	3/-
B¼	Straight quarter rails	„	2/6
BB1	Straight brake rails	each	5d.
BBR1	Straight brake and reverse rails	„	1/6
DS1	Straight rails, double track ...	½ doz.	4/6
RCP	Rail connecting plates	„	4d.

Rails for Electric Trains

STRAIGHT RAILS

EB1	Straight rails	per doz.	7/-
EB½	Straight half rails	„	4/6
EB¼	Straight quarter rails	„	4/-
EDS1	Straight rails, double track ...	½ doz.	8/6

CURVED RAILS

1-ft. radius

EA1	Curved rails	per doz.	8/-
EA1½	Curved half rails	„	5/-
EA1¼	Curved quarter rails	„	4/6

2-ft. radius

EA2	Curved rails	per doz.	8/-
EA2½	Curved half rails	„	5/-
EA2¼	Curved quarter rails	„	4/6
EDC2	Straight rails, double track ...	½ doz.	9/-

CROSSINGS

ECA	Acute-angle crossings	each	4/-
ECR	Right-angle crossings	„	4/-

POINTS

For 2-ft. radius curves

EPR2	Right-hand points	per pair	10/-
EPL2	Left-hand points		

DOUBLE SYMMETRICAL POINTS

For 2-ft. radius curves

EDSR2	Double symmetrical points, right	per pair	12/-
EDSL2	Double symmetrical points, left		

PARALLEL POINTS

EPPR2	Parallel points, right	per pair	12/-
EPPL2	Parallel points, left		
TCPL	Terminal connecting plates (low voltage)	each	1/6

Electrical Points for 1-ft. radius curves are not supplied

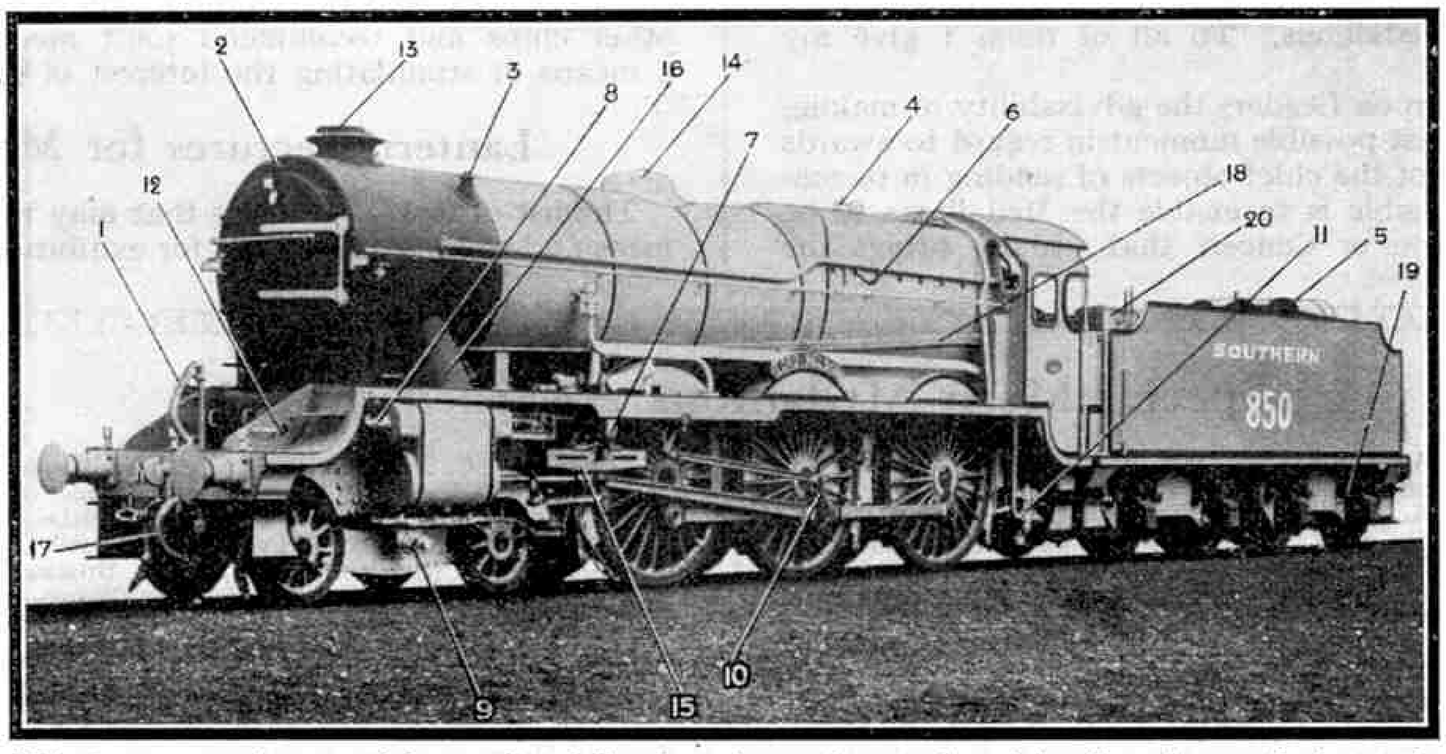
Manufactured by MECCANO LIMITED, OLD SWAN, LIVERPOOL

H.R.C. COMPETITION PAGE

Do *You* Know How a Locomotive Works?

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

THE fascination of a powerful locomotive is perennial and the handsome giants now to be seen on our railways seldom fail to attract admiring glances from passengers of all ages. To-day there are very few people who do not know something about the monsters of the iron road. But these are far more complicated than is usually imagined by those who are not familiar with them. A modern locomotive is something more than a firebox and a boiler, together with cylinders and driving wheels, for in addition it carries innumerable accessories, every one of which plays an important part in enabling it to carry out its tasks efficiently and economically. It is in these that members of the H.R.C. are specially interested. They have almost an expert knowledge of them and in our competition this month we are giving them an opportunity to make use of it.



What purpose is served by each of the twenty parts numbered in the above photograph of the "*Lord Nelson*?" Full details of an interesting competition in connection with these are given on this page.

This competition follows the lines of one that proved extremely popular some time ago. In it entrants were asked to name the controls and fittings marked on a photograph of the footplate of a locomotive, and to add notes on their purposes.

In the present contest competitors are required similarly to identify the chief working parts of a locomotive. The one selected for this purpose is "*Lord Nelson*," the famous engine of the Southern Railway. In the illustration of this locomotive that appears on this page various parts have been numbered and readers are asked to give the name and use of each of these.

Long and detailed statements are not necessary, all that is required in addition to the number and name of each part being a few words to explain what it does. In some cases practically no explanation is necessary, the name of the part being almost sufficient to indicate its purpose. When the list of parts has been completed as far as possible, the competitor's name, address and membership number should be written on the sheet, and the entry should be forwarded to Headquarters in an envelope clearly marked "Locomotive Parts Contest" in the top left-hand corner.

The Contest will be divided into two sections — Home and Overseas. Prizes of Hornby goods (or Meccano if preferred) to the value of 21/–, 15/–, 10/6, and 5/– respectively, will be awarded to the four competitors in each section who submit lists containing the highest number of correct solutions. A number of consolation prizes also will be awarded, and thus no competitor should be prevented from sending in his entry by the fact that he has been unable to find the correct name and use of each part. In the event of a tie for any prize neatness will be taken into consideration in making a final decision.

Envelopes should be plainly addressed and must be posted to reach Headquarters at Binns Road, Old Swan, Liverpool, on or before 28th February, 1930. The closing date for the Overseas section is 31st May, 1930. The omission of the H.R.C. membership number from any entry will cause it to be disqualified.

Painting Contest

In view of the excellent number of entries received, and also the high quality of the work of the competitors in the "Locomotive Drawing Contest" announced in the "*M.M.*" for December last, we have decided this month to hold a Painting Competition, which we think will prove equally popular with our readers.

Any locomotive, British or Foreign, may be chosen for the subject of the painting, and entries may be of as large a size as is necessary in order that details may be clearly shown.

The contest will be divided into the usual two sections—Home and Overseas. Prizes of Hornby Railway material (or Meccano if preferred) to the value of 15/–, 10/6, 5/–, and 2/6 respectively will be awarded in each section. In addition, a number of consolation prizes will be awarded to entries of sufficient merit.

The competitor's name, address, and H.R.C. membership number should be clearly written on the back of each entry. Envelopes should be plainly marked "H.R.C. Locomotive Painting Contest" in the top left-hand corner, and should be posted to reach Headquarters at Binns Road, Old Swan, Liverpool, on or before 28th February. Overseas closing date, 31st May, 1930.

H.R.C. Competition Results

HOME

November "New Word-Finding Contest."—First: C. E. Wrayford (6039), Teigngrace, Nr. Newton Abbot. Second: K. Burrow (3048), Bromsgrove, Worcs. Third: A. L. Jones (5094), Abergavenny, Mon. Fourth: D. L. Walker (1323), Wallasey. Consolation Prizes: E. Blackwell (30), Oswestry. R. Barbary (5580), St. Ewe, Mevagissey, Cornwall. W. R. S. Smart (1502), Harrow.

December "Locomotive Name and Number Contest."—First: H. Ainsworth (1599), London, N.W.7. Second: D. Holder (8613), Leicester. Third: F. A. Lance (1058), London, S.W.11. Fourth: C. L. Jones (29), Nantwich. Consolation Prizes: G. R. Palmer (6610), Leicester; A. E. Poyser (11567), Gloucester; Ian G. Macmillan (4442), Midlothian; G. Hobday (11451), Eastbourne; A. W. E. Hasthorpe (1724), London, N.4.

With the Secretary

Special Merit Medallions

This month I give the names of members of Meccano Clubs to whom Special Merit Medallions were awarded during 1929. The list is very extensive, and I am very pleased to find that so many members have shown sufficient keenness and originality to earn one of these handsome Medallions. To all of them I give my heartiest congratulations.

I should like to impress upon Leaders the advisability of making up their minds at the earliest possible moment in regard to awards of Merit Medallions. One of the chief objects of sending in recommendations as soon as possible is to enable the Medallions to be presented at the Exhibition or Concert that usually brings the session to a close. This is specially important during the present session, for in many clubs the chief event of the year takes place during March or early in April. The names of those who have earned Merit Medallions should be submitted in sufficient time to allow these to be engraved and forwarded for presentation at this function, therefore, the value of these awards being greatly increased by their formal presentation along with prizes earned in Model-building and other competitions held during the year.

Special Merit Medallions Awarded in 1929

ATHERSTONE (Atherstone Grammar School)—F. Cooper, A. Evans, W. C. Stokes. BLACKBURN (Blackburn No. 1)—N. Ferdinand, A. Parkes, J. Shaw, J. Strefkirk. BURTON-ON-TRENT (Albert Village)—R. E. Adey. CASTLE DOUGLAS—S. McEwen, I. Murray, W. Murray, J. Thomson. CHELMSFORD—J. Gratze. CLYDEBANK (Morison Memorial)—R. Bell, R. Stewart. EDINBURGH (Tynecastle School)—W. Didcock, W. Urquhart. EXETER (Heavitree)—J. Burrows, H. Wells. (Folsloe Rangers)—R. C. Brooks, R. Pyne. (St. Peter and St. John's)—H. Brewer, C. Godbeer, C. Ord, E. C. Reed. (St. Thomas Choir)—H. C. Langdon, R. Layman. FALMOUTH (Selwood House School)—E. Ashby. GLASGOW (Victoria)—D. Hart, H. Templeman. GREAT BADDOW—G. Cox, J. Cox, E. Dobson, L. Gascoigne, T. Jackson, C. Marshall, C. Rawlingson, J. Watson. HARWICH—S. Every, G. Howard, W. Hutchins, V. Mitchell. KNUTSFORD (Knutsford Lecture Hall)—A. Pettit. LEEDS (Harehills)—R. K. Fourness, G. Horne, B. Wilson. LICHFIELD—W. Johnson, H. Stoyle. LONDON: (Holy Trinity, Barnsbury)—J. Bailey, A. Deavin, C. J. Dickens, S. Hutton, E. Keats, A. Keeley, A. Mead, G. Moore, G. Owen, E. Stanley. (Kingsbury and District)—J. Bennett, W. Burgess, A. Clark. (Roe Green)—J. Knightley, G. Stokes. (Whitgift Grammar School)—R. T. Furlong, R. Hall. MANCHESTER (Withington Kim)—Mrs. L. B. Ball. MIDDLESBROUGH—W. D. Allick, M. McMahon, J. West. NEWCASTLE-ON-TYNE—B. Haines, K. Mark. NORWICH (St. Peter Mancroft)—R. Jewell, V. Kimm, E. McEwen Smith, J. F. Morley. PERSHORE—D. Cross, T. Pettifer. PLYMOUTH (St. Bartholomew's)—R. Matthews, A. Pickett. PRESTWICH (Sedgley Park)—W. A. Robinson, D. L. Smart. ST. ALBANS—L. G. King, S. A. Rutter. SITTINGBOURNE (Borden Grammar School)—H. W. E. Rivett. SWINDON (Gorse Hill Baptist)—A. Chappell, F. Hicks. WALLINGFORD (Wallingford Grammar School)—L. M. Allen, W. Parsons. WEYMOUTH (Weymouth Central School)—E. Brampton, R. Mogg.

OVERSEAS CLUB MEMBERS.

AFRICA: (Malvern Wesleyan)—A. Clelland, R. Hobson, S. Xenos. (Observatory)—R. O. Beevers, J. Carlile, A. E. B. Moorby, Miss K. Murgatroyd. FRANCE—A. Alt, P. Caradec, R. Delevoy, J. Dubois, S. Dubois, V. Fussi, C. Galeo, A. Gersy, A. Guerindon, M. Levy, P. Louyot, F. Vidy, A. Will.

While on this subject I wish to remind Leaders that two Merit Medallions may be awarded during each session, and that there is no restriction in regard to the kind of work that may be done to earn them. Members may qualify for the award by excellence in model-building, success in recruiting, valuable help in arranging programmes, and generally by diligence and thoughtfulness on behalf of the club.

Interesting Joint Exhibition

I have previously remarked on the increasing tendency shown by neighbouring clubs to hold joint meetings, and I am pleased to note that this has led to many very interesting meetings. One excellent plan is to organise a joint Exhibition. This has been done by the clubs attached to Whitgift Grammar School and Whitgift Middle School, the members of which scored an outstanding success as a result of earnest and well-sustained efforts on the part of members of both clubs.

The Headmaster of one of the Schools kindly opened the Exhibition and Masters from both willingly assisted in judging the models entered in Model-building Contests. A specially interesting feature was the presentation of a Silver Cup for the best model on view. This was won by a member of the Whitgift Middle School M.C., who submitted an original model of the equatorial mounting of a telescope, and the winner was heartily congratulated by members of both clubs.

No doubt the friendly rivalry seen at this Exhibition will be renewed at other functions of a similar character held by the two clubs. I hope that this example will be followed where possible by other clubs and recommend joint meetings and Exhibitions as a means of stimulating the interest of members.

Lantern Lectures for Meccano Clubs

The list of lantern lectures that may be obtained from industrial firms and railway companies for exhibition at meetings of affiliated Meccano clubs has now been extended and revised. It contains an interesting selection of lectures of great variety, ranging from stories of travel and railway work to the production of newspapers and representations of engineering processes of great interest.

These lectures should not be overlooked by those responsible for planning the programmes of clubs and if any means of procuring a lantern may be found, an effort should be made to show at least one during the session. Any of the lectures would provide excellent entertainment at a Visitors' Evening, or form an additional attraction of great interest at an Exhibition.

For the benefit of Leaders and Secretaries who have not yet made use of any of these lectures I wish to point out that arrangements for obtaining the slides or films are made directly with the firms or organisations that lend them, all necessary details being given on a list that may be obtained on application to Headquarters.

Proposed Clubs

Attempts are being made to start Meccano Clubs in the following places, and boys interested should communicate with the promoters whose names and addresses are given below:—

CANADA—R. Grant, 78, Bond Street, Lindsay, Ontario, Canada.
CIRENCESTER—M. Stukley-Barker, c/o Miss Frazer, The Avenue.
DONCASTER—Joseph E. Lovatt, 30, Grosvenor Crescent, Arksey.
HOLLAND—A. Dellevoet, Busken-Huetstraat 5 bis, Utrecht.
IPSWICH—P. Samson, 81, Tuddenham Road, Ipswich.
LIVERPOOL—P. Modridge, 25, Ilford Avenue, Great Crosby.
LONDON—A. R. Carr, 107, Pathfield Road, Streatham.
MANCHESTER—R. Whitehead, 16, Wordsworth Avenue, Cheetham.
MANCHESTER—Robert Booth, Kirk Way, Alkrington, Middleton.
PRITTLEWELL—V. Smith, 87, East Street, Prittlewell, Nr. Southend.

CLUB NOTES

Cranleigh M.C.—Is now settled in new and more comfortable quarters and Model-building activities have commenced. Among the models constructed is one of the Eiffel Tower, with many new features, that was exhibited in a local shop window. A quantity of Hornby railway material has been purchased, and it is hoped to build up an excellent layout. Members constructed an illuminated model for use on Christmas Day in St. Nicholas Church, Cranleigh. Club roll: 12. *Secretary:* J. F. J. Stead, Ewhurst Rd., Cranleigh.

Belgrave (Leicester) M.C.—Most meetings of this newly affiliated club have been devoted to Model-building, and a Crane-building Contest produced excellent models. A series of lectures on "*Printing*" are being given by the secretary, and a Lantern has been obtained. A splendid Library has been formed and is being well used by members. Club roll: 10. *Secretary:* K. J. Hatfield, 25, Acorn St., off Melton Road, Leicester.

Albert Village M.C.—Recent meetings have included a Games Night, a reading of the Guild Lecture, "*The Story of the Motor Car*," a Lantern Lecture kindly loaned by the De Havilland Aircraft Co., and a Social Evening that realised nearly £3. A Visitor's Night was highly successful. Club roll: 41. *Secretary:* L. C. Adey, 239, Occupation Rd., Woodville, Burton-on-Trent.

Edinburgh M.C.—Model-building Evenings have alternated with Lectures and Debates, one on "*Is a Channel Tunnel Desirable?*" arousing great interest. A visit has been paid to the Royal Scottish Museum and a Magazine has been started. Membership continues to improve at a satisfactory rate and a Hornby Train Section of the club is to be formed. Club roll: 50. *Secretary:* R. Croall, 16, Bangholm Avenue, Trinity, Leith.

Wolverley M.C.—A Lecture and Demonstration on "*Electric Power*" was given by the father of one of the members. The lecturer presented a Meccano Motor as a prize for a Model-building Contest. Competitions are frequently held. In the most recent the winning model was a Hay Elevator, a Three-wheel Runabout securing second place. In the interests of tidiness a system of fines for leaving library books about in the club room has been instituted. Club roll: 33. *Secretary:* W. F. G. Gadsby, Bury Hall, Wolverley School, Kidderminster.

Ashby Boys' Grammar School M.C.—An interesting talk on "*Photography*" was given by Mr. Eckersley, the first Leader of the Club, and visits have been paid to a local Biscuit Factory and a Bakery. The second Annual Exhibition was a striking success, a record number of visitors being specially attracted by models of the "*Harmonograph*" and "*Ship Coaler*" on loan from Headquarters, and a comprehensive Hornby Train layout that surrounded most of the exhibits. A Lantern Lecture "*The Story of the Daily Express*," the slides for which were kindly loaned by the newspaper concerned, provided an interesting and instructive entertainment. Club roll: 63. *Secretary:* R. W. T. Moore, "Summerfield," Wilmot Rd., Swadlincote, Burton-on-Trent.

Wallington County School M.C.—A visit was paid to the Model Engineering Exhibition. Two excellent Lectures have been given and a Model-building Speed Contest has been held, entrants being required to build models correctly in the least possible time. Club roll: 14. *Secretary:* H. Bond, "West View," Plough Lane, Wallington, Surrey.

St. Columba's (Sunderland) M.C.—Model-building Competitions and Talks on the uses of Meccano parts have figured prominently in the programme. In one Competition entrants were asked to design a lift and in judging special attention was paid to gearing. Club roll: 23. *Secretary:* T. Crute, 28, Ridley St., Southwick, Sunderland.

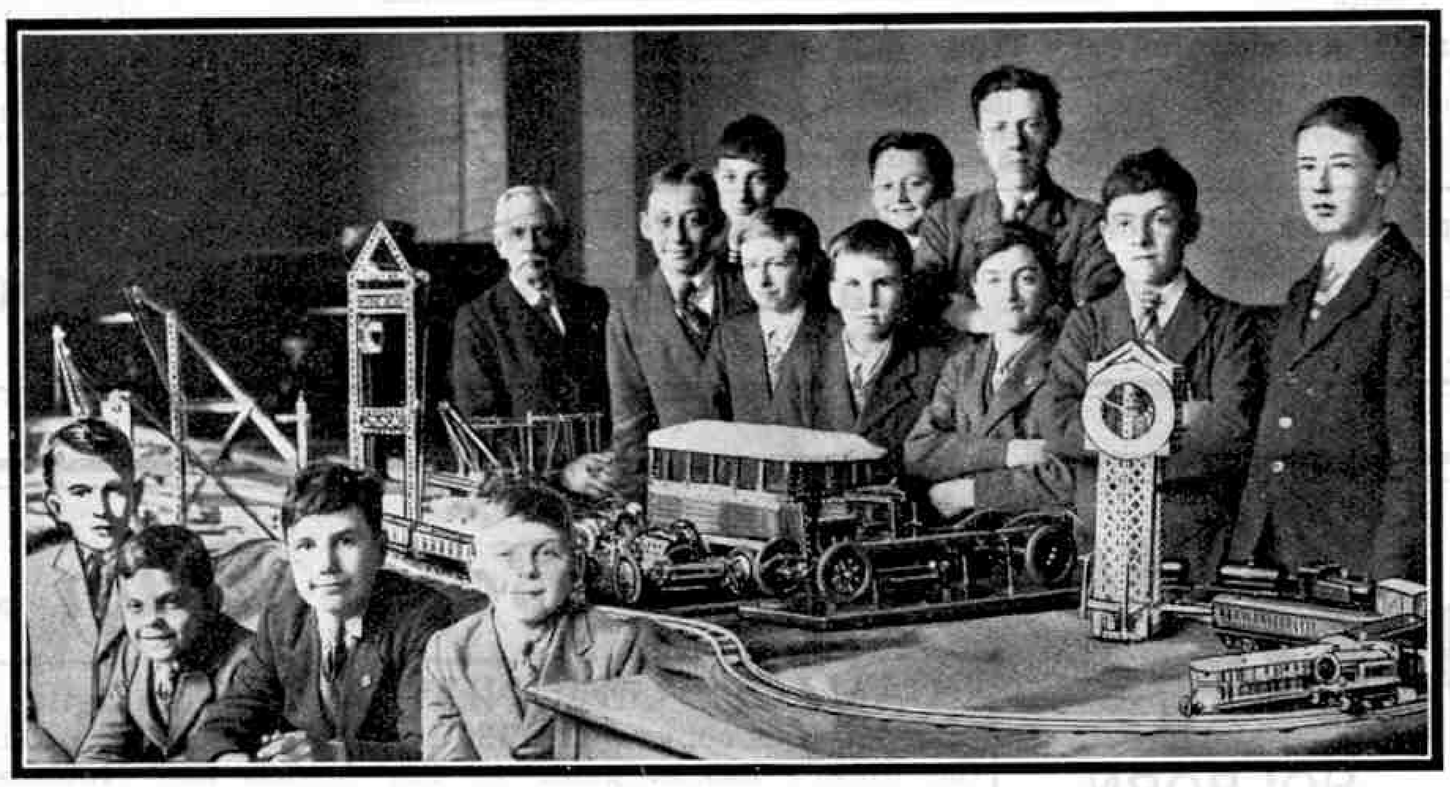
Braintree County High School M.C.—Interesting lectures have been given on "*Railway Engines*" and "*Water*," the last-named dealing with characteristics of water found in various districts. Sections for Stamp Collecting and other hobbies are being formed. Model-building Competitions are keenly contested. Club roll: 29. *Secretary:* P. Allen, St. Edmund's, Bocking, Braintree, Essex.

Roe Green M.C.—Model-building is carried on at most meetings, and on one occasion Simplicity Models only were made. On Hornby Train Nights goods and passenger trains have been operated on several interesting layouts. A Firework Display during November was highly successful. Club roll: 18. *Secretary:* P. J. Wallis, 1, Elmwood Crescent, Hay Lane, London, N.W.9.

Pershore M.C.—In a recent Model-building Competition the chief prize was awarded for a splendid model of a seaplane. The Library is making good headway, many magazines of engineering interest being included. It is hoped to obtain a special room in which to construct a permanent Hornby Train layout. Club roll: 21. *Secretary:* D. Cross, Church Street, Pershore.

Fulstow Junior M.C.—A Motor Show Evening was very successful. Each member constructed a Motor Car and entries were judged by a motor expert, points being given for steering gear, neatness, etc. The winning model was a neat racing car with extremely efficient steering gear. Club roll: 13. *Secretary:* L. W. Doe, The Stores, Fulstow, North Thoresby, S.O. Lincs.

Exmouth Y.M.C.A. M.C.



This club was affiliated in February of last year, and under the thoughtful guidance of the Leader, Mr. C. J. Berry, who in our photograph is standing on the left of the back row, it has since grown into a very progressive and prosperous organisation. Model-building is of a very high standard, and the many excellent models shown in the club's First Annual Exhibition created great interest.

Whitgift Grammar School M.C.—Lectures on "*Famous Engineers*" and "*Cams*" have been given, and members enjoyed an interesting talk by Mr. W. Hawkins, Leader of the Hobart, Tasmania, M.C. An Exhibition was held jointly with the Whitgift Middle School. The attendance was excellent and the models shown included an exceptionally neat two-seater Coupè, Log Saw, Meccanograph, "Fokker" Monoplane. Club roll: 38. *Secretary:* R. T. Furlong, 49, Kilmartin Avenue, Norbury, S.W.

Mill Hill M.C.—An excellent scheme followed in this club is the holding of fortnightly Model-building Contests, the winning model in each being exhibited in the window of a local Meccano dealer. A visit has been paid to the Science Museum at South Kensington. The excellent Library continues to grow in size and usefulness. Club roll: 12. *Secretary:* I. D. Bateman, 97, Mill Way, Mill Hill, London, N.W.7.

Gorse Hill M.C.—A visit was paid to the Moredon Electricity Works, the modern plant installed having recently been put into operation. An Exhibition was held in conjunction with the Church Bazaar, the net proceeds amounting to £1. A model Hornby Train layout complete with Tunnels, Stations and Goods Yards equipped with Trains was a great attraction to the 200 visitors. Club roll: 18. *Secretary:* F. H. Draper, 159, Ferndale Road, Swindon, Wilts.

Halifax M.C.—An Exhibition extending over four evenings attracted a record number of visitors, and these were very greatly interested in the working models on view, which included Pit Head Gear, Warehouse with Lift, Travelling Crane, Repair Wagon for overhead transmission lines, Telpher Span and large Wheel. Club roll: 12. *Secretary:* Mr. H. Ramsbottom, 155, Warley Road, West End, Halifax, Yorks.

Orwell (Milnathort) M.C.—The first Model-building Competition of this newly affiliated club was very successful and was followed by a Visitors' Night that attracted a large attendance. Most of the models displayed were of Locomotives and other railway objects, and a Meccanograph aroused keen interest. Lectures have been given on "*Types of Steering Gear*" and on "*Geo. Stephenson.*" The last-named was illustrated by Meccano models of the "*Rocket*" and of a modern locomotive. Club roll: 33. *Secretary:* Miss E. D. Hepburn, Rutherburn, Milnathort, Kinross-shire.

Newcomen (Hull) M.C.—A Cinematograph Exhibition and Talks have been given, one on "*Astronomy*" by the Leader being particularly interesting. Model-building Nights have been held regularly, points being awarded for the best constructed. A large train layout was constructed by members. Club roll: 10. *Secretary:* H. Acklam, 103, Newcomen St., Hull.

Whitgift Middle School M.C.—An Exhibition held jointly with the Whitgift Grammar School M.C. was opened by the Headmaster. Entries in Model-building Contests were judged by Mr. A. J. Taylor, a Master of the School, who also assisted in judging the models on view at the Exhibition. A Silver Cup for the best model was won by D. M. Corde, a member of the Whitgift Middle School M.C., with an original model of an Equatorial Telescope Mounting. Club roll: 30. *Secretary:* A. W. Quick, 87, Sandy Lane South, Wallington, Surrey.

Preston Embee M.C.—Most meetings are devoted to Model-building but interesting Lectures on "*Aeroplanes*" and on "*Electricity applied to Meccano Models*" also have been given. An interesting Talk was given to members on the making of wooden bases on which to mount Meccano models. Many members have since constructed bases of this kind. Club roll: 25. *Secretary:* Mr. J. Drysdale, c/o Merigold Bros., 147/8, Church Street, Preston.

St. Peter Mancroft (Norwich) M.C.—Members of this club are divided into Senior and Junior Sections that meet on separate evenings, meetings held on Saturdays being open to all members. At one meeting the Leader gave a description of the recent Motor Show at Olympia. Other events have included a successful Social and a Christmas Party at which the play "*Nonsense Nana*" was presented. Club roll: 25. *Secretary:* J. W. M. Vyse, 51, Cardiff Rd., Norwich.

Hendon M.C.—An Exhibition has been held. This was well advertised by means of posters and more than 200 people attended, the proceeds amounting to £5. The models on view included a Block-setting Crane, Motor Chassis, Dredger, and a large Biplane, while among the Side-shows were a Shooting Gallery and a large Hornby Train layout. A model that attracted special attention was a Meccano Safe with a combination lock. On the track many accidents occurred, but it was noticed that visitors became more interested when these happened and were eager to help in putting things right. A Firework Display, a Mock Trial, and a Speed Contest for clockwork Racing Cars were held at other meetings. Club roll: 15. *Secretary:* J. V. Goldsbrough, "Romsdal," Neeld Crescent, Hendon, London, N.W.4.

Sittingbourne Pioneer M.C.—An interesting novelty in the programme was a Combat Evening, when Meccano "knights," armed with lances and mounted on clockwork "horses," indulged in fierce fights in the "lists." Table-Tennis tournaments are held quarterly. The member who scores most points in each quarter holds the "Ashes" for three months. These are the remains of a table-tennis ball that have been placed in a small casket. Members have redecorated the club room in preparation for the Exhibition. Club roll: 10. *Secretary:* R. J. Hampshire, 2, Charlotte St., Milton Regis.

Elm Road (Beckenham) M.C.—A novelty was the "*How To Do and Make*" Evening. Members were divided into teams and given various tasks such as repairing an electric lamp and connections, fitting a washer to a water-tap, replacing blown-out electric fuses, soldering, and fitting up optical instruments. Great interest was shown in the reasons behind the methods employed. The Annual Social was a great success, Competitions, Games and an inter-team Charade being greatly enjoyed. Club roll: 14. *Secretary:* C. W. Price, 52, Queens Rd., Beckenham, Kent.

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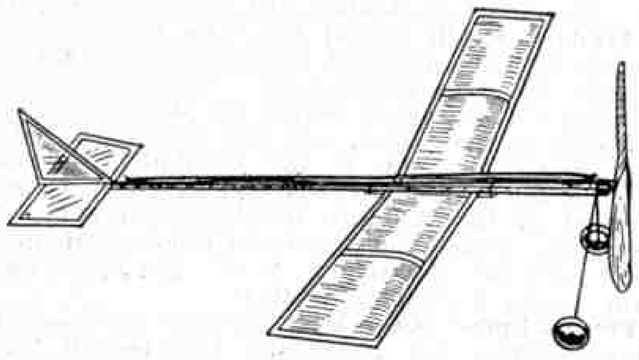
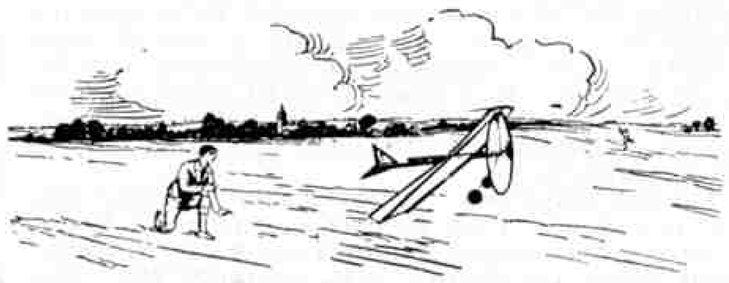


The "Moth" Tractor. Price 4/6

Length 19 in., span 18½ in., fitted patent double bearing and shock-proof chassis, 8 in. hand-carved and balanced propeller, covered red proofed silk. A splendid flyer, and beautifully finished, this model at the price is undoubtedly the finest value ever offered.
(Patent No. 296946).



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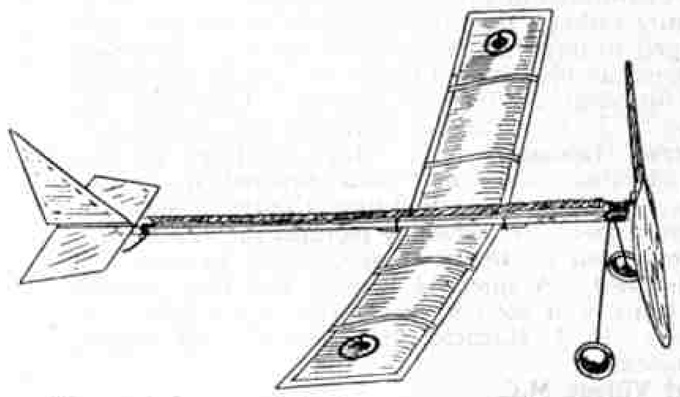

The "Demon" Tractor. Price 7/6

Length 25½ in., span 23 in., fitted 10 in. hand-carved and balanced propeller, patent double-bearing and shock-proof chassis, covered yellow proofed silk with identification discs. Weight and wind resistance are reduced to a minimum in this model, giving the utmost duration of flight.
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The "Warneford Marvel" Construction Set. Price 1/6. Builds a 15 in. "Tractor" Type Flying Model, weighing only ¼ oz. (Complete Set of parts in Sealed Box). This is the lightest Model for its size ever produced, will rise from the ground, and can be adjusted for stunts, or to climb vertically into the air. The parts are made from the lightest wood in the world, and specially imported by us for these models. The length is 11 in., span 15 in., a 7½ in. propeller, and fibre wheels with double bearing metal centre, all wire and metal parts, including wheels and chassis, being finished ready to assemble, and is complete with **Full Size Working Drawings** and explicit instructions.

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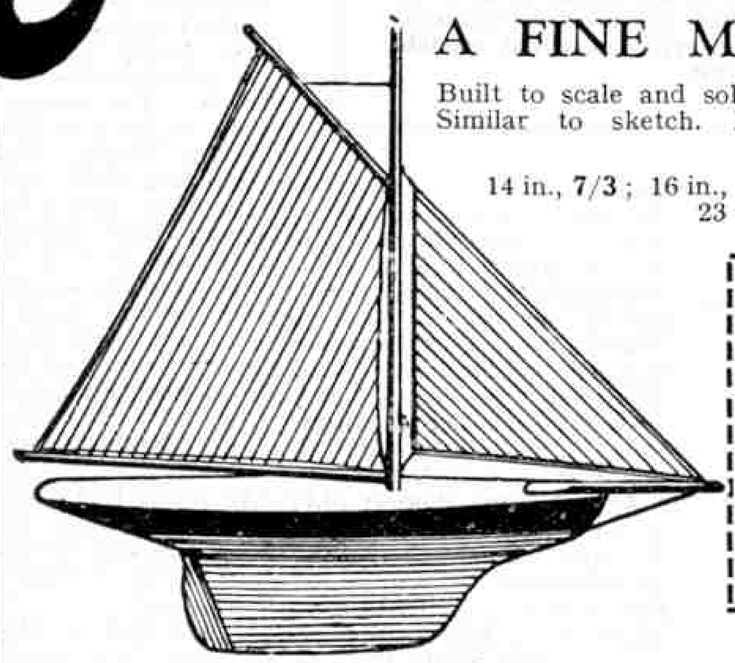

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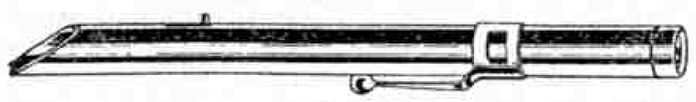

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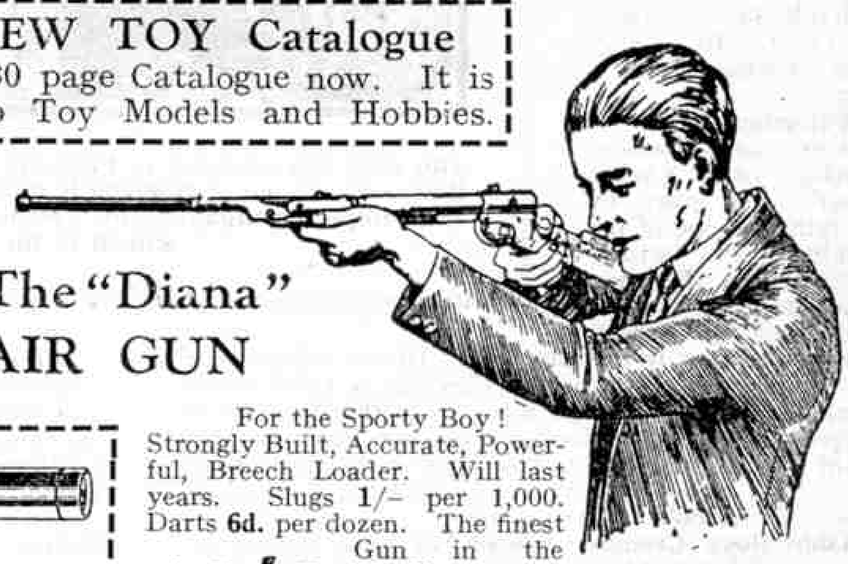

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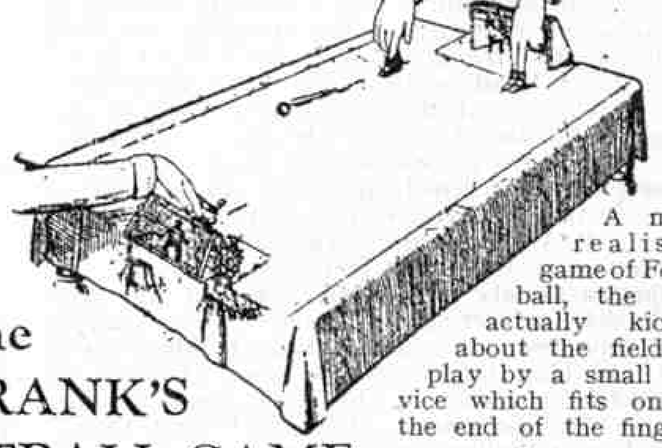
MODEL SPEED BOAT

Built of African Mahogany and fitted with long-running c.-w. motor, finished with finest marine varnish. Length 18 in. Natural mahogany colour, Green lines. Post 9d. Price **16/6**



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A most realistic game of Football, the ball actually kicked about the field of play by a small device which fits on to the end of the fingers.

Prices **3/6** and **7/6**

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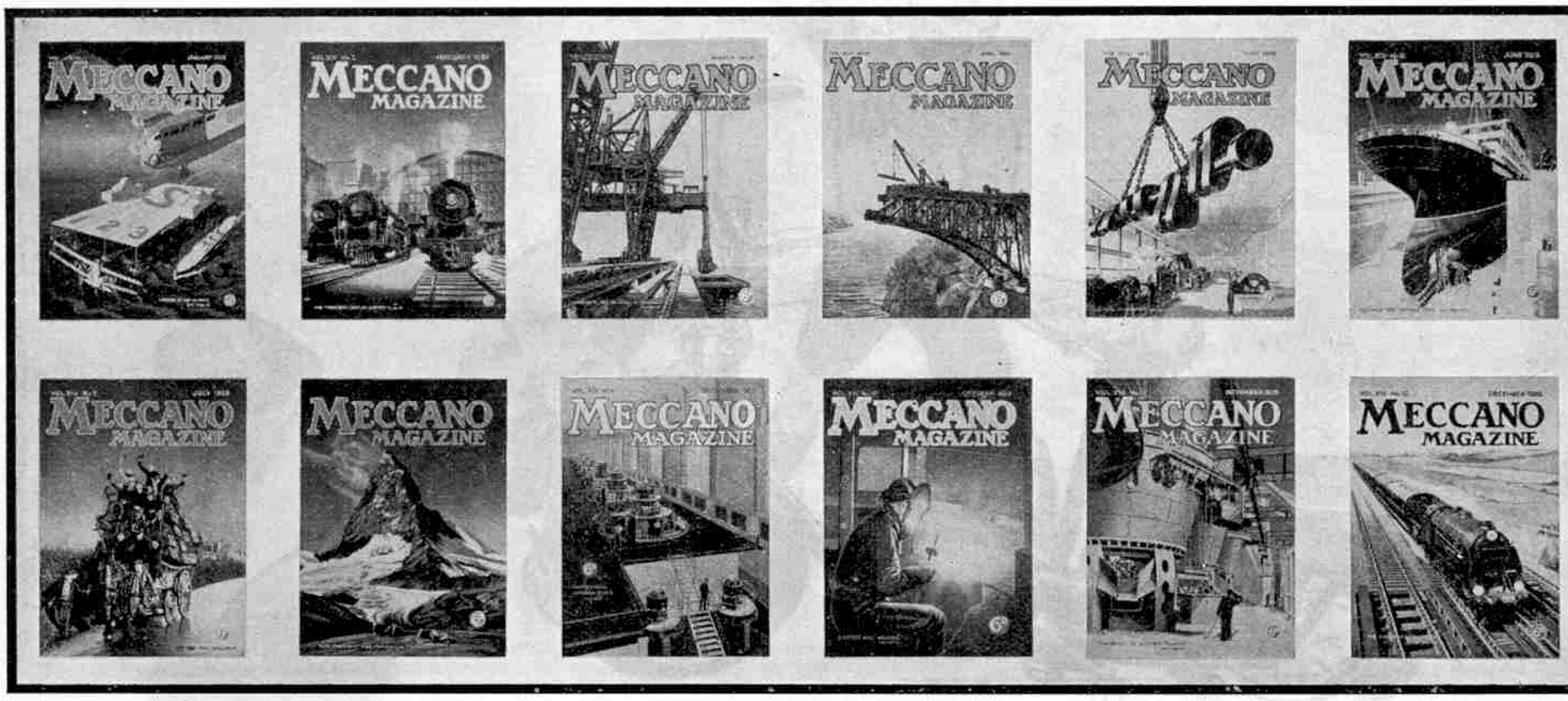
Competition Page



Which were the Most Popular Covers in 1929?

In the above illustrations the beautiful coloured covers that appeared on the various issues of the "*M.M.*" during 1929 are displayed in reduced form in their published order—January to June in the upper row, July to December in the lower.

The "*M.M.*" covers are among the most striking that are published to-day, and therefore it is not surprising that opinions should differ as to which are the most effective ones. Many readers will recall the interesting voting contests held to judge the best covers in each of the four previous volumes, and we are sure that the opportunity of expressing an opinion on the 1929 covers will be welcomed by everyone.

The reproductions above are intended for reference purposes only, but new readers will find them of great assistance in forming their judgment, although, of course, the brilliancy of the colour of the originals is lost. Those readers who possess copies of the 1929 issues will be well advised to compare the originals.

Referring to each cover by its month of issue, each competitor is asked to write the following two things on a post card:—

(A) The 1929 cover he likes best of all.

(B) His idea of the order of popularity of the covers as decided by the massed vote of all the competitors. This list must cover the whole year, every month being included. The name of the month must be given, not its number in the volume.

The entrant's name and address must be added to the card, which should be addressed "Cover Voting Competition, Meccano Magazine, Binns Road, Old Swan, Liverpool." No competitor may submit more than one entry.

Prizes of Meccano goods (to be chosen by the winners) to the value of £1/1/–, 15/–, 10/6 and 5/– respectively, will be awarded to the four competitors whose lists most accurately forecast the final result. In the event of a tie for any of the prizes preference will be given to the entry displaying the neatest or most novel presentation. In addition there will be a number of consolation prizes. Closing date, 28th February. Overseas, 31st May.

A DILEMMA

I have always considered Meccano boys, as a class, to be the most ingenious boys living. Their hobby has taught them that "cannot" and "impossible" simply ought not to be in the dictionary. The words are meaningless, for there is a way out of every difficulty.

During the Christmas Holidays I very proudly proclaimed my belief to a relative whose long residence abroad has put him out of touch with boys, and he was—well, to put it mildly, sceptical. I fear I became rather nettled, and I challenged him to set a problem, of any description, that would baffle a Meccano boy. I must confess I got a shock when I read his problem, but my relative assures me that the victim of the dilemma got out of it!

Here is the problem: A white man in a forest jungle is forced to climb a tree to escape a lion at which he has fired and missed. His unloaded and now useless rifle lies at the foot of the tree and he is weaponless save for a hunting knife. He has also a coil of stout rope and a length of strong cord. The tree is on the south side of a small clearing. A few yards to the west of the tree there is a strong-flowing alligator-infested river. To the south and east there are trees. The nearest tree south is too far away to be reached by climbing from branch to branch, and the nearest tree on the east contains a very ugly-looking poisonous snake coiled asleep. How can the hunter escape, assuming, of course, that neither the lion nor the snake leave the scene of operations?

Prizes of Meccano Products, value 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the four best solutions in order of merit. In addition, there will be a number of consolation prizes.

Entries must not exceed 500 words in length and must be addressed to "Jungle Escape, Meccano Magazine, Binns Road, Old Swan, Liverpool." They must be sent to reach this office not later than 28th February. Overseas closing date, 31st May.

COMPETITION RESULTS

HOME

Cricket Opinion.—First Prizes: Section A, R. B. Harris (Bradford); Section B, C. D. Bates (Stokenchurch, Bucks.). Second Prizes: Section A, L. Broadley (Batley); Section B, S. H. Westlake (Camberwell, S.E.5).

Figurewords. 1. E. Smith (Sheffield); 2. G. Govas (East Sheen, S.W.14); 3. S. W. Hardisty (Cockermouth); 4. A. L. Cumberland (Palmer's Green).

Expressions.—First Prizes: Section A, K. Shellard (Dalkey, Co. Dublin); Section B, R. R. Pearce (Bishops Stortford); Second Prizes: Section A, H. V. Parkin (Sutton); Section B, J. P. Wain (Horsforth, Leeds). Consolation Prizes: R. W. V. Adams (Deal); G. W. Gunson (Galgate, Nr. Lancaster); G. S. Marsh (Blackpool); A. Steven (Glasgow); G. Wright (York); J. F. Kitchen (Bolton); S. Waller (Stockton-on-Tees); R. C. Randall (St. Albans); J. R. Farebrother (Norbury, S.W.16); J. Burgess (Dukinfield, Cheshire); T. S. Lucas (South Ascot).

OVERSEAS

41st Photographic Contest.—First Prizes: Section A, V. Vella Zast (Valletta, Malta); Section B, R. Parnell (Sliema, Malta). Second Prizes: Section A, F. Van Bulck (Brussels); Section B, C. Galles (Valletta, Malta).

June Crossword Puzzle.—C. W. Cam (Montreal); 2. J. MacL. Gooch (Victoria); 3. T. Brown (Mussoorie, India); 4. B. W. Monk (Adelaide).

come on you chaps!

Look at this Fairycycle! With balloon pneumatic tyres; powerful brakes and glittering handlebars—what a bike! What a proud machine to ride! Fancy going out to tea on it! Fancy turning up at school on it! Fancy the other chaps crowding round! Yes, you must wangle a Fairycycle.

Every possible detail of equipment on her. Dunlop balloon tyres for solid comfort, tangent spoke wheels with glittering plated rims; bell, pump, tool bag with real tools; stand, so that she stays upright when not in use, and carrier for the mater's parcels. Moreover, any Fairycycle can be fitted with a flat plate between the saddle and the handlebars showing a realistically painted motor cycle engine! Yes, the No. 8 Fairycycle is a machine in a thousand and is so strongly built that when you are big enough to hand it on to a small brother or sister it will still be well worth handing on.

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FAIRYCYCLE

Fairycycles are made in the following sizes at the prices stated:

Model A.—Well finished in black cycle enamel, ball-bearing pedals and plated handlebars. Dunlop saddle, 12″ tangent spoke wheels, $\frac{5}{8}$″ rubber cushion tyres - **29/6**

Model Ax.—Like Model A, but larger size, with 14″ wheels and $\frac{5}{8}$″ rubber cushion tyres - **33/–**

Model B. — Very suitable for young children, being light and easy to ride. Has 12″ tangent spoke wheels with $\frac{7}{8}$″ rubber tyres. Complete with chain-guard, reflector, stand and carrier - - - **39/6**

Model Bx.—As Model B but larger size with 14″ wheels and $\frac{7}{8}$″ rubber cushion tyres - **42/–**

Model C.—Raised pattern plated handlebars, has chain guard, stand, carrier, reflector and bell. Cycle pattern rim brake, **12**″ tangent spoke wheels, adjustable ball-bearing hubs, 1″ imitation pneumatic tyres - **49/6**

Model Cx.—As Model C but larger size with 14″ wheels - **52/6**

Model Px.—As Model Cx but with 14″ × $1\frac{3}{8}$″ Dunlop "Kempshall" pneumatic tyres - **55/–**

Model D.—Cycle type brakes, raised pattern plated handlebars, 2-coil spring saddle, etc. $\frac{1}{2}$″ × $\frac{1}{8}$″ roller chain, adjustable ball bearings throughout. 12″ tangent spoke wheels with 1″ imitation pneumatic tyres, complete with chain-guard, stand and carrier, reflector and bell - **59/6**

Model 6.—Strongly built for children up to 9 or 10 years old. 16″ tangent spoke wheels fitted 1″ imitation pneumatic tyres, adjustable ball-bearings throughout, cycle pattern rim brake. Imitation pneumatic tyres, 3-coil spring saddle, tool bag, bell, etc. - - - **70/–**

Model 8.—The "Rolls-Royce" of Fairycycles, raised pattern plated handlebars, $2\frac{1}{4}$″ buttress tread Dunlop balloon tyres. Plated ball-bearing pedals, tool bag, carrier, stand, bell, reflector and pump, etc. - - **87/6**

All these Models with the exception of Models A and Ax are finished in black or blue, with gold lines. Fairycycles can be obtained at all good toy shops, or write for illustrated leaflet.

FAIRYCYCLE ASSOCIATION
Membership free to owners of genuine Fairycycles and badge attached to every machine. Simply fill up the form when you buy your Fairycycle, post it to Lines and you will then become a member. This is the badge of the Fairycycle Association.

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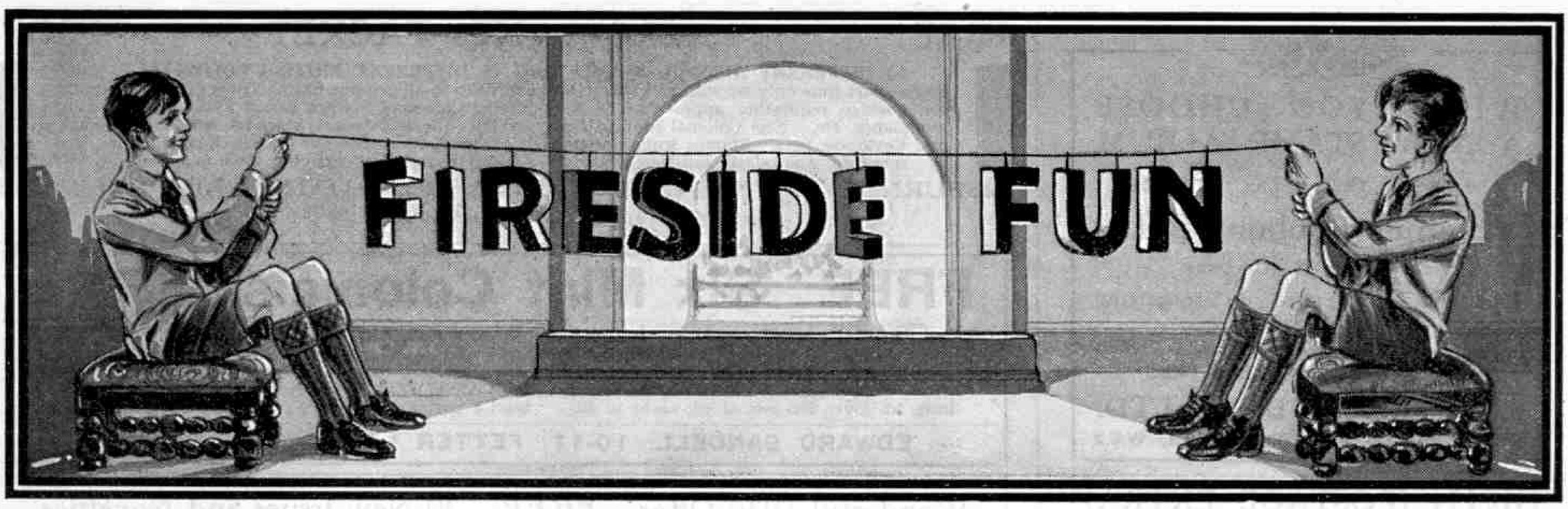


SAFETY FIRST

Boy: "Mother, do you trust me?"
Mother: "Yes."
Boy: "Are you sure?"
Mother: "Yes."
Boy: "Then why do you lock the jam up in the cupboard?"

* * * *

It was Tommy's first day at school and on returning home he was asked how he had liked it.

"I liked it alright," said Tommy, "but I didn't get any present."

"What made you think you would get a present?"

"Teacher said 'Sit there for the present,' and I sat there all morning and never got one!"

* * * *

Doctor: "I think I had better give you a local anæsthetic."

Railway Employee: "Well doctor, if it's going to hurt I think you had better cut out the 'local' and run me through on a sleeper!"

* * * *

Foreman (to employee arriving late): "Look here, my man, have you any idea of the time they start work in this factory?"

Employee (habitually late): "I really couldn't say; they're always working when I get here!"

* * * *

First Workman (during dinner hour): "What's the matter with Joe? He seems bothered."

Second Workman: "He's got a splinter in his hand."

First Workman: "Well, why doesn't he pull it out?"

Second Workman: "What, in his dinner hour? Not likely!"

* * * *

"Why do you wear your glasses in bed?"

"I am so short-sighted that I can't recognise the people I dream about!"

* * * *

Mrs. Jones: "I simply can't get Tommy to keep himself clean and tidy. All his clothes are ruined the first day he puts them on."

Mrs. Green: "That's too bad. My Johnnie is just the opposite. Sooner than soil a clean handkerchief by wiping his slate he borrows one from another boy."

* * * *

THE PRELIMINARY

A Scotsman was engaging a caddy. He looked over the possibles with an appraising eye and singled out a sharp-looking boy.

"Laddie," said he, "are ye good at finding lost balls?"

"I am, sir," replied the caddie eagerly.

"That's fine," said the Scot, "Find me half-a-dozen and we'll start straight away!"

* * * *

Teacher: "Why were you absent yesterday?"

Boy: "Please sir, when I was coming to school I saw a steam roller."

Teacher: "Well, what about it."

Boy: "A man tapped me on the shoulder and said 'Mind that steam roller, boy.' So I stood minding it all afternoon."

INSPIRATION

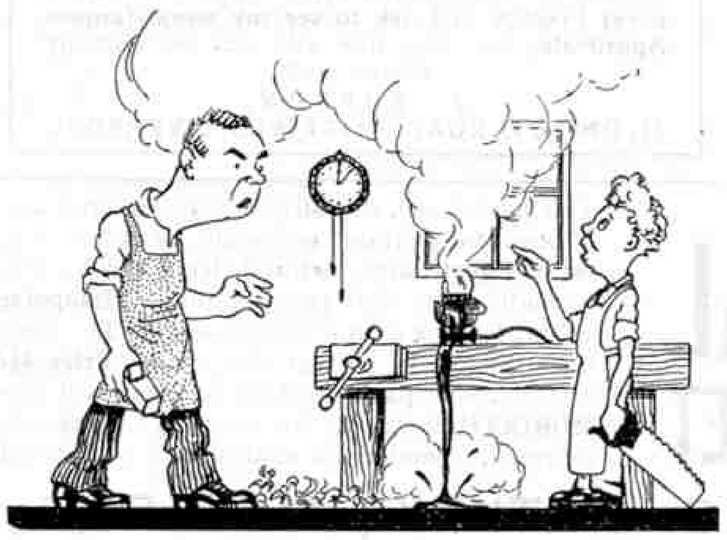
A patient teacher was trying to show a small boy how to read with expression. "Where—are—you—going?" read Johnny, laboriously, with no accent whatever.

"Try that again," said the teacher. "Read as if you were talking and don't overlook that mark at the end."

Johnny studied the interrogation mark a moment, and an idea seemed to dawn upon him. Then he read triumphantly: "Where are you going, little button hook?"

* * * *

HE KNEW EXACTLY!



"Hey!" cried the carpenter to his apprentice, "didn't I tell you to notice when the glue boiled over?"

"Yes," answered the boy, "it was just a quarter past ten."

* * * *

"Excuse me," he said, as he entered the Country Editor's office, "you Editors are supposed to know everything. How should I treat sick bees?"

"With respect," was the answer.

* * * *

Bertie's school report had been received. "I'm losing patience with you!" exclaimed his father. "How is it young Jones is always at the top of the class while you are at the bottom?"

The boy looked at his father reproachfully. "You forget, Dad," he said kindly, "that Jones has awfully clever parents."

* * * *

A Boy Scout was being instructed in the art of serving at table in order to win his cooking badge. He had been told always to ask if the guest would have any more when taking away his plate.

The Scout remembered this, but the result was unfortunate.

Having taken the plate of one of the guests he said: "Will you have any more, sir?"

"Yes, please" was the reply.

"I'm sorry, sir, but there isn't any left," was the answer that nearly doubled up the instructor with laughter!

* * * *

Recruit: "Shall I mark time with my feet, sergeant?"

Sergeant: "Did you ever hear of marking time with your hands?"

Recruit: "I understand clocks do, sergeant."

* * * *

A schoolmistress, taking a class of boys in arithmetic asked one small boy: "What are four sevens?"

The answer came immediately, "Twenty-eight!"

"That's good," said the mistress; "very good indeed!"

"Good, indeed!" said the smart little boy indignantly; "I call it perfect!"

* * * *

Mother: "I wouldn't punish Tommy this time, father. Wait till he does it again."

Father: "But suppose he doesn't do it again?"

NOT WHAT THE JUDGE MEANT!

Judge: "Now, I don't expect to see you here again, Rastus."

Rastus: "Not see me here again, Jedge? Why you ain't going to resign yo' job, is you, Jedge?"

* * * *

Expert (teaching novice to drive a car): "In case of emergency, the first thing you have to do is to put on the brake."

Novice: "Why, I thought it was already on the car!"

* * * *

A pedestrian, bumped by a taxi, found himself lying in the street directly in the path of a steam roller.

"That reminds me," he cried, "I was to take home some pancake flour!"

* * * *

Mike: "I hear there was a burglary last night at the draper's."

Pat: "Yes. A good job it didn't happen the night before, for it was only yesterday that all the prices were marked down by half!"

* * * *

"What on earth are those brown spots on your suit?"

"Oh, that's rust!"

"Rust?"

"Yes, my tailor said it would wear like iron."

* * * *

Billy was cleaning father's boots and was taking a long time to do it.

"Haven't you finished those boots yet?" shouted father.

"Almost; I am doing the second," replied Billy.

"Well, where is the first?"

"I'll do that when I've finished the second."

* * * *

Warder: "You'll have to work here, but you are allowed to choose your own trade."

Convict: "Well, if it's all the same to you, I'd like to be a sailor!"

SOME BAIT!

The water bailiff saw a man angling on a stretch of water that was strictly preserved. He rushed up and was just about to order the offender off the estate when he noticed that his hook was baited with a piece of carrot. The bailiff's wrath vanished and he burst out laughing. "If that's the bait you use, guv'nor," he said, "go ahead!"

Some hours later the bailiff was returning that way. The angler was still there and his basket was bulging.

"Good heavens," cried the bailiff, aghast. "You never caught all these trout with a piece of carrot, did you?"

"No," replied the angler, smiling broadly. "I caught *you* with that bait!"

* * * *

Pat: "Have you christened your new baby yet?"
Mike: "Aye, shure we have."
Pat: "An phwat do you call it?"
Mike: "Hazel."
Pat: "Bad cess to ye! With two hundred an' twenty-three saints to name the kid after, ye had to go and name it after a nut!"

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15	"	10d.	25	"	8d.
10	Bulgaria	2d.	30	"	1/–
15	"	4d.	35	"	1/4
20	"	6d.	40	"	2/–
25	"	9d.	10	Dutch Indies	2d.
10	Ceylon	2d.	15	"	4d.
15	"	4d.	20	"	6d.
20	"	6d.	25	"	9d.
10	Chili	2d.	30	"	1/–
15	"	4d.	5	Esthonia	2d.
20	"	6d.	10	"	4d.
25	"	9d.	15	"	6d.
30	"	1/–	10	Finland	2d.
10	Cuba	2d.	15	"	4d.

J. RUSSELL

Chetwynd, Shanklin Drive, Westcliff-on-Sea

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For a short time only we will send this remarkable offer to all genuine Stamp Collectors who send 2d. for postage requesting approvals. Twelve different Air-mail Stamps issued 1919-1923, depicting aeroplanes, etc. Fine Colonial Stamps from Gwalior, Jamaica (arms), splendid African, Canadian, and Ceylonese Sets. Stamps from Queensland, Hyderabad, Straits and Indian Native States, and sets from Australasia and New Zealand. Absolutely free, but cost of postage must be sent.

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FREE Six Mint Colonials FREE

I send FREE SIX MINT BRITISH COLONIALS, one each from KEDAH, ZANZIBAR, Kenya, TURKS & CAICOS Is., SOUDAN and CAYMAN ISLANDS—and ALL MINT, to any collector at Home or Abroad sending a postcard for my large new Illustrated Price List (No. 8) containing over 1,200 items: Stamps, Albums, Sets, Packets, Accessories—in fact EVERYTHING FOR THE STAMP COLLECTOR. Prices from 1d. (over 200 sets at 1d. each) to 40/–. Send a postcard only—no cash—and ask for No. 200.

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Wonderful 1930 Offer FREE 30 New Issues and Novelties

Including Austria, **Belgium (1929 lions)**, Canada, Cuba unused), **Falkland Is.** (penguin), F.M.S., Fr. Guiana, Fr. India (new issues), **Guatemala $1.50** (Cat. 4d.), Holland (1929), Italy (wolf), **Nyassa,** Poland (1929), Roumania, Russia (unused), **Spain (Catacombs)**, Switzerland (1867), Ukraine, Upper Volta (native chief), **Vatican State.** I will send this collection **absolutely free** to all stamp collectors sending 1½d. postage (abroad 2½d.). Only one gift to each applicant. **Mention 1930 offer.**

G. P. KEEF, Mortimer Lodge, Wimbledon Park, LONDON, S.W. 19

FREE! 50 Different Portuguese Colonials

This wonderful gift contains Stamps from Angolia, Azores, Cape Verde, Lourenzo Marques, Mozambique, Congo, Portuguese India and Guinea, St. Thomas and Princes, etc. **Send 2d. to cover Postage and ask to see my world-famous Approvals,** and this fine gift will be sent by return post.

J. BURTON, 31, ONSLOW ROAD, FAIRFIELD, LIVERPOOL.

FREE THE GREATEST GIFT OF ALL

To those asking to see our Famous Approvals and List of Stamp Bargains we will give 300 GENUINE COLONIAL & FOREIGN STAMPS.

No Duplicates. All Different. (Cat. over 25/–). 4d. stamps to be sent towards packing and postage (overseas 6d.).

WITHOUT APPROVALS, price is 1/7

R. WILKINSON, Trinity St. W., Llandudno

THE "ORIENTAL" PACKET

This packet contains **30** *good class* **Oriental** stamps only (no common continentals) and is mostly comprised of beautifully printed pictorials, views of towns, ruins, mosques, minarettes, gateways, etc. Set of **Palestine,** set of **Egypt** (large pictorial, King Fuad, etc.). Set of **Turkey** (including "Wolf" type). Set of **6 Algeria** (including 50c. and postage due). **Mesopotamia** (large pictorial). **Syria** (pictorial). **HEJAZ** (Mecca) a quaint looking stamp usually sold at 3d. Set of **4 Persia** (obsolete), **Levant** (unused). Set of **8 Tunis** (new issue, pictorials, postage due, etc.). **Price 4½d.** only, postage 1½d. extra (abroad 2½d. extra). **Purchasers** of the above packet asking for approval sheets will be presented with a unique set of **10 PICTORIAL MOROCCO,** including Air post. This *fine* set is usually sold at a 1/–. Satisfaction guaranteed or money returned. Senders of addresses of stamp collecting friends will receive another set in addition **FREE.**

H. C. WATKINS, M.M. Dept., Granville Road, BARNET

"DIAMONDS"

MANY RARE STAMPS have been found by purchasers of **The "DIAMOND" Packet,** which is guaranteed to contain 1,000 Unsorted Stamps from Convents abroad, **1/3.** 2 packets **2/5**; 3 packets, **3/6**; 4 packets **4/6**; 5 packets **5/6.** All post free. (Abroad 3d. per pkt. extra).

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Vatican Packet FREE!

A fine packet of **All Different Stamps** containing the new issue of the **Vatican State,** a **Jamaica 2/–, Hayti** 1904 Centenary **Cat. 9d., Medellin** 1913 Unused pictorial, **Indore, Cilicia** surcharged **Cat. 3d., Central Lithuania, Deccan, Lebanon, Kouang-Tcheou, Bulgaria** pictorial, **St. Pierre and Miquelon, Victoria** 1901, etc., free to all asking to see my famous approval sheets and **enclosing 2d. for postage and packing (abroad 3d.).**

S. HAMMOND, 2, CHESHAM FIELDS, BURY

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from which you may select any **100 FOR 3/–.** More advanced Collectors are requested to ask for my selections of separately priced stamps.

Special Terms to all my old customers.

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285, Archway Road, London, N.6.

SPECIAL OFFER

FREE. 20 diff. Portuguese and 20 diff. French Colonials, with approvals. Gift 103. Stamps from ¼d. each. State requirements.

WAY, 17, High Street, Epsom.

Triangular Fiume, Virgin, Falkland (new), Irish O'Connell, Morocco, Brunei, Vatican, Iceland, Persia, Colombia, Gibraltar, Malta, Kenya, 4d. post free. St. Lucia War Mint free if you desire approvals.

J. R. MORRIS, 9, Audley Rd., Folkestone, Kent.

PERSIA PACKET FREE

This **Fine Packet** contains **505 Unsorted Foreign** stamps including unused. This mixture is collected for us by **Convents Abroad,** and many scarce have been found by customers. A Set of **5** different large bi-coloured **Pictorial Persia** is included. Send for a Packet and spend a pleasant time sorting them over. It is offered **Free** to Genuine applicants asking for **Half Price** approval sheets and enclosing **2d.** stamp for actual postage. (Abroad 8d. P.O.). Mention Persia Pkt.

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3d. each / **6d. each**

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6d. each: 10 Allenstein, 100 Austria, 50 Belgium, 10 Bel. Congo, 5 Cayman Is., 15 Ceylon, 10 Cochin, 50 Czecho, 30 Danzig, 50 Denmark, 10 Dom. Repub., 30 Finland, 50 France, 9 Georgia, 25 Greece, 5 Holkar, 100 Hungary, 6 Iraq, 12 Jamaica, 5 Johore, 5 Kedah, 10 Kouang Tcheon wan, 5 N. Mongolia, 8 Palestine, 50 Poland, 50 Portugal, 6 Rhodesia (N. and S.), 10 Straits, 5 Vatican, 5 Zanzibar.

SPECIAL OFFER :—The above 60 pkts. for **21/–** post free. **FREE**—Any one 3d. pkt. to applicants for Approvals and Free List of 1,750 "Bumper" pkts. Send 1½d. postage. Postage extra on orders under 5/–.

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FREE PICTORIALS FREE

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The most Wonderful Gift ever offered to Stamp Collectors! Comprising: **Watermark Detector,** All Metal **Perforation Gauge, Rustless Tweezers,** Marvellous **"Matlock"** Mounts, Transparent Envelopes and famous **Syria Air Post Stamp,** all contained in Handsome Metal Gift Casket with Hinged Lid, showing the highest precipice in England at Matlock—the Home of Stamp Collecting. Send 3d. and request approvals—or if 4d. be sent a **Powerful Magnifying Glass** in Folding Metal Case will be included in the Casket.

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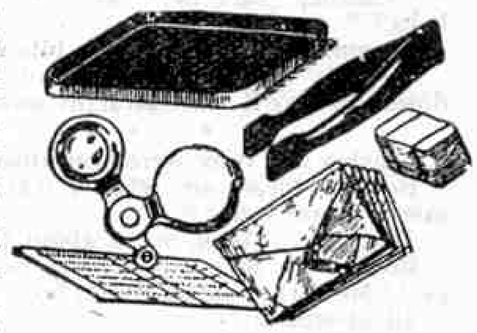


Stamp Collecting

Notes on Recent Issues

A Philatelic "Crime"

Belgium, usually most meticulous in the administration of her postal affairs, has committed a philatelic crime—the production of a completely unnecessary variety of the Orval Abbey charity stamps that were issued at a premium in 1928 to raise funds for the restoration of the Abbey buildings.

Prince Leopold of Belgium laid the foundation stone of the reconstruction work on 19th August last, and in celebration of the occasion, 25,000 sets of Orval Abbey stamps were overprinted with a royal crown, the monogram *L* and the date 19.8.29. By Postal Regulation the stamps were made available for use up to 30th April, 1930, but apparently they were on sale for a strictly limited period, and only at the Orval post office. A small quantity was sold and then the stamps were withdrawn and handed over to the Abbey Restoration Committee, who in their turn have passed the stock on to an agent for disposal for the benefit of the Abbey funds.

No doubt the whole arrangement is most commendable as a means of raising money for a good cause, but from a philatelic standpoint it is highly reprehensible.

When the original series was issued, pressure on our space prevented us from illustrating the stamps, and we take the opportunity now. There are nine values in the set, ranging from 5c.+5c. to 10 fr.+10 fr., four exceedingly well-produced designs being employed. The 5c. and 25c. values, both of which were sold at a premium of 5c., show a striking design of "ogives," or pointed Gothic arches, for which Orval is famous. A second design shows a robed Cistercian monk stone-carving, this being used for the 35c. and 2 fr. values, which were sold at 10c. and 40c. premiums respectively. The 60c., 1 fr. 75c. and 3 fr. values (premiums 15c., 25c., and 1 fr.) show a picture of the legendary incident of the return of Duchess Matilda's ring by a fish that had found it on the bed of a stream. The fourth design, 5 fr.+5 fr. and 10 fr.+10 fr. values, shows the ruins of the Abbey with monks at work in the surrounding fields.

"Mad Anthony" Commemorated

The United States Postal Authorities have issued a two-cent stamp as a memorial of General Anthony Wayne, who died in 1829. General Wayne was one of the most prominent characters of the American Revolution. He was born in 1745. As a young man he entered into the struggle for freedom with great ardour, and in the early days of the war raised a regiment with which he took part in the disastrous invasion of Canada.

Later Wayne became closely associated

with General Washington, and his daring exploits earned for him the name of "Mad Anthony." In spite of the reputation suggested by his name he was gifted with wonderful judgment, and showed this during a dangerous mutiny of a portion of the American Army. He boldly entered the camp of the mutineers, and by his presence and the restraint that he exercised he succeeded in winning their confidence and preventing them from becoming completely out of hand.

General Anthony increased his already great reputation by pacifying the Indian tribes of the North-west frontier. These tribes opposed the extension westward of the Americans, and succeeded in defeating with great slaughter an American force. "Mad Anthony" restored American prestige, defeating some of the tribes in battle and overthrowing others by the erection of a fort on the site that to-day is covered by the city of Fort Wayne. It was in 1794 during his Indian campaign that the Battle of Fallen Timbers, mentioned on the face of the stamp, was fought, resulting in the death of some 1,309 Indians, and his association with the West is further indicated by the introduction in the memorial of the figures of two frontiersmen.

A Royal Collection

King Fuad of Egypt, by his recent purchase of Mr. Mackenzie Low's collection of proofs and essays for Egyptian stamps, at a cost estimated to run well into four figures, becomes possessed of what is undoubtedly the largest known collection of Egyptian postal issues. The Mackenzie Low collection was to have been sold by auction in London during the third week in October, but as soon as the King heard of the forthcoming sale he took steps to acquire the collection by private treaty.

In addition to those of his own country, King Fuad is keenly interested in the stamps of the countries adjacent to Egypt—Palestine, Syria, Transjordania, Abyssinia, the Sudan, Hedjaz and Nedj. His general collection alone occupies 35 volumes and contains several famous rarities. The complete collection is in the charge of a special official.

Air Mail "Fakes"

Aero-philately undoubtedly is the branch of stamp-collecting that offers the greatest possibilities for speculative buying and, like most other forms of popular speculation, it has attracted the attention of the gentry who live upon the gullibility of those who spend their spare cash on "bargains." Bargains often can be picked up, but, in the stamp collecting world, they are rarely genuine when "offered" as such, except when the source of the offer is a known reputable dealer. High value rarities of good condition will always command their full market value, and therefore suspicions may be entertained quite justly when "bargains" are on offer from unknown sources.

Air mail "fakes" are becoming prevalent and readers are warned to be on their guard.

(*Continued on page 163*)

PRE-WAR—500 assorted Stamps, 6d.—Smith, 48, Belgrave Road, Ranmoor, Sheffield.

FREE. 50 Stamps to applicants for my cheap approvals.—Kenyon, 44, Granville Rd., Blackburn.

FREE. 100 Stamps to all approval applicants.—Knowles, 16, Withycombe Road, Exmouth, Devon.

100 Different Stamps Free. Send for ½d. approvals. Letters only.—Cox, 3, Mornington Mansions, Westcliff-on-Sea.

FREE ! 20 diff. French Colonials to applicants for my low-priced approvals.—Caple, La Casita, Fownes Road, Alcombe, Minehead.

BRITISH COLONIALS. Ask to see my collection. 600 different on approval, all same price, ½d. each stamp.—Bickers, Lordswood Avenue, Southampton.

APPROVALS. Fine Range of attractive sets and singles at clearance prices. 10 Monaco or 12 Chili free, if postage 1½d. is sent.—W. E. Williamson, 179, Gordon Road, London, S.E.15.

ST. HELENA PICTORIAL SET FREE
A new set of Stamps from this British Possession sent free of charge to bona-fide applicants for selections of duplicates on approval.
HENRY TURNER
110, Barnett Road, Preston, Brighton, Sussex.

GENUINE BARGAIN PACKET
No. 586. Post Free 3d. Contains 110 different Stamps, including Monaco, Kedah, Iraq, Malta, Siam, Angola, S. Rhodesia, Upper Volta, Ecuador, etc., etc., and all purchasers who **ask for approval sheets** receive
4 NEWFOUNDLAND FREE.
New Approval Sheets ready. Grand variety. Good Discount. Write for a selection to-day. Duplicates exchanged. Exchange desired with all Colonies.
F. G. ROWE, 63, EDGEHILL RD., BOURNEMOUTH.

U.S.A.
The current issue, very fine used.
½c. to 13c. and 17c. Various Presidents' Portraits, etc. 14c. Indian, 15c. Statue, 20c. Golden Gate, 25c. Niagara Falls, 30c. Bison, 50c. Amphitheatre, $1 Lincoln Memorial. The set complete 2/- (postage extra).
The Month's Stamp News.
My useful Monthly List is post free and tells of many other fine offers.
GEORGE LAZENBY,
16, Redburn Drive, Shipley, Yorks.

YOUR OPPORTUNITY and THERE IS NO SNAG IN IT.
£25 IN CASH PRIZES.
We are celebrating our Jubilee year by giving away £26 in 62 cash prizes to the buyers responsible for effecting the greatest number of stamps sold from our world famed approval sheets during the year 1930.
FIRST PRIZE £10 BANK OF ENGLAND NOTE.
Full particulars and a set of Siamese Stamps sent absolutely FREE on receipt of your name and address by
Department 33,
Errington & Martin, South Hackney, London, E.9.
Established 1880.

ALL APPROVALS HALF-PRICE
Dozens of Approval Sheets of Colonial and Foreign, including old and new issues all to be cleared at half marked prices. Plenty of bargains from ½d. upwards. List of free gifts sent with approvals.
50 British Colonials free to first 20 applicants.
MISS M. SAUNDERS,
16, KENT ROAD, EAST MOLESEY, SURREY.

Have You Seen Them ?
MY RECORD APPROVALS.
Huge discount of 8d. in 1/- allowed, or 9d. in 1/- for a nett purchase of 2/6 or more. My approvals being **absolutely the cheapest and best, no free gifts** are given.
RECORD STAMP COMPANY,
23, Canning Road, East Croydon.

" MECCANO MAGAZINE " BINDERS
Your Magazines may be kept clean and tidy by enclosing them in one of the special binders we supply. Two sizes, price 3/- and 4/6 post free, from Meccano Ltd., Old Swan, Liverpool.

OUR CRICKET BAT CONTEST

It is very evident from the steady flow of entries that has been reaching us during the past few days that our cricketing readers do not intend lack of effort to be their excuse for failure to win the autographed cricket bat that is the principal prize in this contest. The fact that only one reader can win the bat must not deter any would-be competitor from making his attempt. There are dozens of consolation prizes to be won, and each of these is well worth having.

For the benefit of new readers we must explain that during their visit to Liverpool last summer to play the Lancashire County Cricket XI, the South African Cricket tourists visited the Meccano factory, and, at the request of the Editor, autographed a specially-chosen cricket bat for presentation as a prize in an "*M.M.*" contest. Subsequently the bat was autographed by the Lancashire XI, and also by Mr. Frank Hornby, inventor of Meccano and Managing Director of Meccano Limited.

Full details of the bat and the competition that is being held to decide which Meccano boy shall become the fortunate owner, were given on page 955 of the December "*M.M.*" There is still time to take part, for the closing date is not until 31st March. Competitors are not required to rely upon their own unaided efforts; they may enlist the help of parents, uncles, cousins and friends. We are looking forward to a bumper entry, and in the meantime the bat, together with a photograph of the South African team, taken on the occasion of their visit to the factory, will be on view in the windows of prominent Meccano dealers in various parts of the country.

During February 1930, the bat is on view as follows :—

4th to 8th Feb. ... ... J. Robertson, 94, Northumberland Street, Newcastle-on-Tyne.
11th to 15th Feb. ... ... R. Scupham & Sons, 35, Linthorpe Road, Middlesbrough.
18th to 22nd Feb. ... ... Saxon's (Sunderland) Ltd., 29, Holmside, Sunderland.
25th Feb. to 1st March ... A. Lascelles, 90, Northgate, Darlington.

How to Get More Fun—(*Continued from page 147*)

of a locomotive to be changed by reversing the current it is necessary to use a motor having a permanent magnet instead of an electro-magnet, for then the direction of the magnetic field is fixed. The advantages of being able to reverse a locomotive as well as to vary its speed by means of a controller are so great that a special locomotive of this kind has now been introduced into the Hornby system. This is known as the No. 1 Permanent Magnet Tank Locomotive. It may be operated only from a 6-volt accumulator.

The resistance controller used for this locomotive has two levers, one of which is used for varying the speed of the locomotive and the other for changing its direction. Fig. 2 shows how the connections to it and the track are made. From the positive terminal of the accumulator connection is made through the controllers to the centre rail 2 by means of wires 8 and 6 and the connecting plate, which is secured by key 3. The return current is carried by means of the wires 7 and 9. Speed is controlled by means of the lever 10, while the direction of the locomotive is governed by the position of the lever 11.

Opportunity for Meccano Boys

In next month's issue we hope to announce a very interesting competition that we are organising with the co-operation of R. A. Lister & Co. Ltd., of Dursley, Glos., and in which valuable prizes will be offered for the best Meccano models of the petrol-driven Lister Auto-truck. Meccano boys who are able to visit the British Industries Fair at Olympia, London, W., can inspect the actual truck at the Lister Stand (No. 1, Block 17G).

Modelling for Scouts

Messrs. Harbutt's Plasticine, of Bathampton, Bath, send us a splendidly illustrated booklet "Plasticine for Scouts and Guides," dealing with the multifarious uses to which Plasticine may be put in the training and camp life of Scouts, Cubs, Guides and Brownies.

The interesting feature of the booklet is that it is compiled solely from the experience of members of the Scout and Guide Organisations, and many highly interesting and novel suggestions are made for the benefit of those seeking novel ways of training boys and girls to use their natural powers of observation.

How to get the booklet is fully explained in Messrs. Harbutt's advertisement on page 175.

A Meccano Aerial Ropeway

(*Continued from page 134*)

so that the gripper does not foul any of them. After a little experiment the correct adjustment will soon be found.

Fig. 3 should now be consulted. This illustration shows the far side of the operating station to that in the general view, and the hauling rope may be identified by the number 14. First taking the far side of the station (in Fig. 3), the hauling rope passes over the guide Pulley 10 and also round a second guide Pulley. From here it is passed round the upper 6″ Pulley 7, rove through the jockey Pulley 9, round the second 6″ Pulley, over the guide Pulley 11, and finally leaves the station via another guide Pulley. This, it may be mentioned in passing, comprises a ½″ loose Pulley, retained on an 11½″ Rod by a Bush Wheel and a Collar.

The object of the jockey Pulley is, of course, to keep the hauling rope taut. It consists essentially of a 3″ Pulley secured on a short Rod, which is journalled in two 2½″ Strips. The latter are bolted securely to a Fork Piece, to which the cord from the weight is attached.

We may now effect the final small but important adjustments. The first that should be attended to is the adjustment of the ramp 5 that effects the disengagement of the buckets from the hauling rope. It will be evident that this is effected by the ½″ Pulley 23 of the gripper riding up the slope of the ramp 5, thereby opening the jaws of the gripper and releasing the hauling rope. The important point to grasp is that if the slope of the ramp be too abrupt the bucket, when released, will stop. Hence it is necessary to arrange matters so that the ramp has a smooth and gentle curve. The same applies to the ramp 6.

Another point requiring attention is the position of the guide Pulley 11. This must be adjusted so that when the jaws of the gripper are opened by the ramp, the hauling rope springs into the open jaws, when it is immediately clamped by the closing of the jaws.

Dried peas will be found suitable as the material to be transported. Sand or similar fine substances should not be employed.

1,000 PACKET A WONDERFUL OFFER
The "**1,000** Packet" contains **500** excellently assorted Stamps, a COMPLETE SHEET of **100** UNUSED (very useful for exchange purposes); a neat **12-page** booklet for holding duplicates; **25** British Colonials, usually sold at ½d. to 1d. each, including new and obsolete issues; **375** Magic "Strip" Mounts, and my price list of stamp bargains. Price **4½d.**, postage **2½d.** extra, abroad **6d.** extra. In addition, free sets will be sent to those who send names of stamp collecting friends. *Ask for my famous approvals.*
H. C. WATKINS, M. Dept., Granville Road, BARNET.

Stamp Collecting—*(Continued from page 161)*

Notable Stamps of 1929

It is always interesting to glance back over a year of progress and survey quietly the outstanding incidents of the year, in the light of future developments. Without doubt, for philatelists the recently ended year was one of the most interesting of

modern times, and rarely have there been so many new issues of outstanding interest.

Pride of position, of course, must go to the Vatican City issue that was described in our December issue, for the recognition of the long-disputed sovereignty of the Pope was a political event of prime importance. Strangely enough, the second most popular issue was also associated with the recognition of Roman Catholic rights. This was the Irish Free State's issue in celebration of the centenary of the passing of the Catholic Emancipation Act. The Church figured largely in stamps last year, for another very popular issue was the Monte Cassino commemorative issued by Italy, and illustrated in our issue for December.

There have been several issues of considerable beauty and of these, Japan's new air stamps and "Shrine of Ise" issues, that we hope to illustrate in our next issue, must be accorded preference, although Switzerland's Pro Juventute issue, illustrated on this page, is very little inferior. Canada's excellent pictorial general issue—easily the best British issue of the year—and Australia's air stamp, illustrated in the August *"M.M."* also must be accorded high places. The Pro Juventute stamps are certainly outstanding among charity issues, among which particular reference must also be made to Denmark's "Cancer Fund" set. This stamp is another of this month's illustrations.

In addition to the British issues already mentioned there have been several others, but only the West Australian centenary commemorative has any real claim to merit. The Great Britain Postal Union Congress commemoratives, South Africa's 4d. and 1/– air stamps, and the Falkland Isles general issue, all have several bad points of design or production; nevertheless, they have enjoyed considerable popularity among collectors and are entitled to rank among the leading issues of the year.

The Christmas Charity Stamps

Switzerland's Pictorial Issues

The most popular of all Christmas charity stamp issues is Switzerland's Pro Juventute series. These have appeared regularly every year since 1915, and many striking and beautiful designs have been employed. This year's set, however, surpasses anything that has been achieved previously, and our readers, we know, will share our pleasure after inspecting the illustrations of the designs that we show on this page. Unfortunately, simple half-tone reproductions cannot do justice to the beauty of the colouring of the originals.

The 5c. value shows a view of a sunset over Lake Lugano, the crimson tones of the sky and their glorious reflections being brought out in masterly fashion. This is probably the most beautiful stamp of the set, although it is challenged very keenly by the 10c. value, showing a view over the Lake of Engstlen. The colouring in this case is a warm brown for the trees, foreground and frame, and the lake and mountains in the background are rendered in a steely blue tint. The 20c. value gives a rugged view of the Lyskamm taken from above the Riffelalp, the colouring being blue. The fourth stamp of the set, the 30c. value, breaks away from the pictorial and is purely historical. It shows a portrait of Nicholas von der Flue, the Swiss hermit patriot.

Von der Flue's principal claim to fame is that it was his advice that saved the country's independence when the fate of the Confederation hung in the balance in the latter part of the 15th century. Up to the age of 50 he had led the life of an ordinary family man, and his intense patriotism had not manifested itself to any extraordinary degree, but when he reached the age of 50 he determined to forsake his family and wife, to leave his home, and become a hermit, that he might the better pursue his studies of Swiss policy and be able to help his country in the trying times that he foresaw ahead.

This set is certainly the most beautiful charity issue of the year, and we understand that in future years similar efforts will be published, alternating with the small "Arms of the Cantons" type that has hitherto had practically a monopoly of this series.

Mention of the "Arms of the Cantons" issues reminds us that Germany appears to have taken a lead from Switzerland in the designing of her Christmas charity efforts, and for the second Christmas in succession is featuring the arms of States comprising the German Confederation. Our illustration is from the 1928 series, and shows the arms of Hamburg. The same design is used for 1929 with, of course, alterations in the date and with the arms of other States introduced.

Although not of outstanding beauty the series is well produced and should prove popular. It was issued on the 1st of November, for Child Welfare purposes, and there are five issues altogether, ranging from 5 to 50 pfennigs, issued at premiums ranging from 2 to 40 pfennigs. The arms represented on this year's series are those of Bremen, Lippe, Lubeck, Mecklenburg-Schwerin and Schaumberg-Lippe.

Luxemburg is another country that apparently is following a set plan for the designs of its Christmas charity issues. This year's series shows a portrait of Princess Marie Gabrielle, the fourth child of the Grand Duchess, following portraits of the three elder Royal children, Prince Jean (December, 1926), Princess Elizabeth (December, 1927), and Princess Marie Adelaide (December, 1928). Presumably the series will be completed with the next issue showing Prince Charles, the youngest member of the family.

Holland, however, appears definitely to have broken away from the practice of using the arms of its constituent States in the Christmas charity designs. In 1928 portraits of historical figures were used and this year the four denominations, 1½c., 5c., 6c., and 12½c. values, employ a curious design showing a baby boy perched on a very plump fish, riding the waves of the Zuider Zee. The stamp, both in design and production, resembles very closely the recent Olympic

games series, and presumably is intended to be a companion to that set.

The Belgian charity series, issued this year in aid of the Anti-Tuberculosis Fund, contains some very striking designs, one featuring the British War Memorial at the famous Menin Gate at Ypres, and others showing splendid views of Antwerp harbour, and the Canal and Belfry at Bruges.

(Continued on page 173

HORNBY SERIES

HORNBY ROLLING STOCK

GAUGE 0

Hornby Rolling Stock includes almost every type in use on the big railways, and a selection of the splendid range available is illustrated on this page. The various items are modelled on realistic lines and are beautifully enamelled, mostly in the correct colours of the L.N.E., L.M.S., G.W. or Southern Railways.

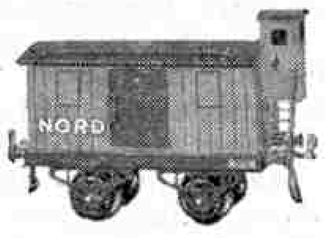
Ask your dealer to show you the full range of Hornby Rolling Stock.

PETROL TANK WAGON "PRATTS"
Finished in green.
Price **2/6**

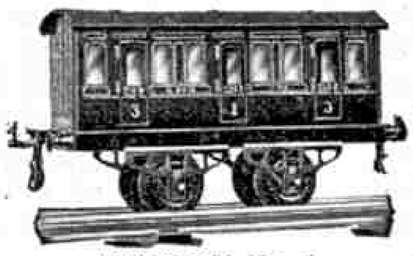
MOTOR SPIRIT TANK WAGON "B.P."
Finished in yellow.
Price **2/6**

PETROL TANK WAGON "SHELL"
Finished in red.
Price **2/6**

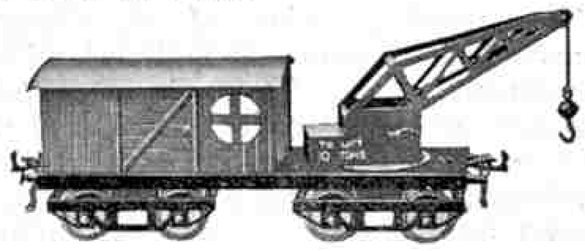
PETROL TANK WAGON "REDLINE"
Finished in blue and red.
Price **2/6**



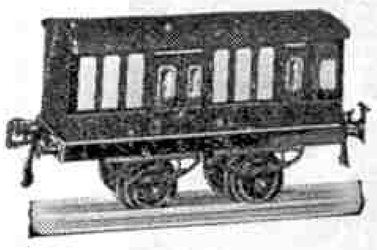
BRAKE VAN (French Type)
Lettered "Nord." Beautifully finished in colours. Opening doors. Price **4/-**



***HORNBY No. 1 PASSENGER COACH**
Realistic in design and fitted each side with opening doors. Price **2/6**



***BREAKDOWN VAN AND CRANE**
Beautifully coloured in brown and blue, with opening doors. Suitable for 2-ft. radius rails only. Price **6/3**



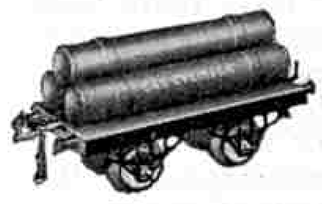
***GUARD'S VAN**
Realistic design, fitted each side with opening doors. Price **2/6**

WAGON (French Type)
Lettered "Nord."
Highly finished in colours. Price **3/3**

BITUMEN TANK WAGON "COLAS"
Finished in blue.
Price **5/-**

ROTARY TIPPING WAGON
Finished in orange. Price **3/-**

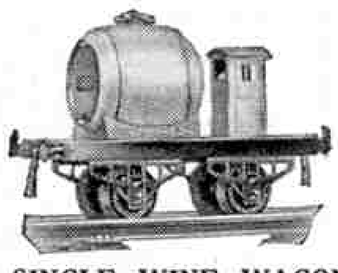
RIVIERA "BLUE" TRAIN COACH
"Dining" or "Sleeping."
This is a beautiful model, substantially built and well finished. Suitable for 2-ft. radius rails only.
Price **12/6**



***GAS CYLINDER WAGON**
Finished in red, lettered gold. Price **2/6**

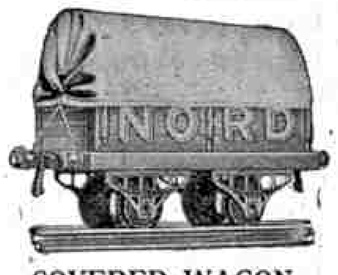
MILK TANK WAGON "UNITED DAIRIES"
A very realistic model, finished in blue and white. Price **5/6**

SIDE TIPPING WAGON
Excellent design and finish. Lettered "Robert Hudson Ltd.," or "Sir Robert McAlpine and Sons." Price **2/6**

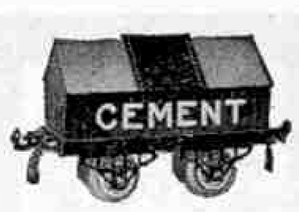


SINGLE WINE WAGON
An interesting model of the single-barrel type of wine wagon used in France. Finished in red and green.
Price **3/9**

HORNBY PULLMAN COACH COMPOSITE Nos. 2-3
As supplied with Nos. 2 and 3 Pullman Train Sets. One part is designed for passenger accommodation and the other for conveyance of luggage. Suitable for 2-ft. radius rails only.
Price **11/6**

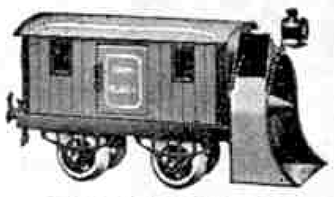


COVERED WAGON (French Type)
This new wagon is fitted with frame and sheet. French type, lettered "Nord." Price **2/6**

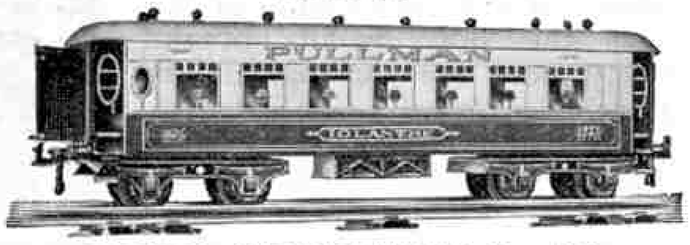


***CEMENT WAGON**
Finished in red.
Price **3/-**

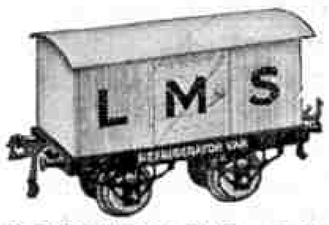
***TIMBER WAGON No. 1**
Beautifully enamelled in green and red. Price **1/9**



***SNOW PLOUGH**
With revolving plough driven from front axle.
Price **5/6**



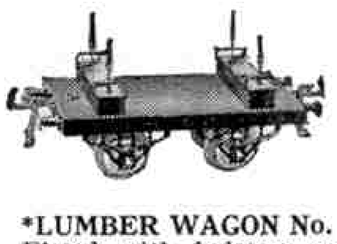
HORNBY PULLMAN COACH Nos. 2-3
As supplied with Nos. 2 and 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only. Price **11/6**



***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors.
Price **3/9**

***LUGGAGE VAN No. 1**
With opening doors.
Price **3/6**

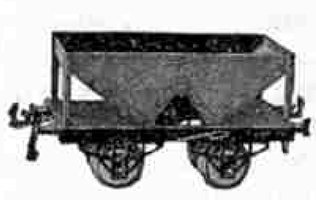
***GUNPOWDER VAN**
Finished in red, with opening doors. Price **3/9**



***LUMBER WAGON No. 1**
Fitted with bolsters and stanchions for log transport. Price **2/-**

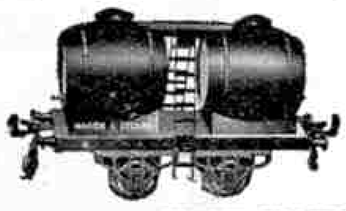
***TROLLEY WAGON**
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **5/6**

***CRANE TRUCK**
Finished in brown and blue. Price **3/6**

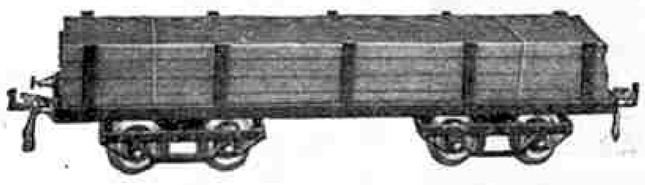


***HOPPER WAGON**
Mechanically unloaded.
Finished in green. Price **4/-**

***MILK TRAFFIC VAN**
Fitted with sliding door, complete with milk cans.
Price **3/6**



DOUBLE WINE WAGON
An attractive model, artistically enamelled in red and green. Price **3/9**



***TIMBER WAGON No. 2**
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **3/6**

BRAKE VAN
Finished in brown, with opening doors. Obtainable in N.E. or S.R. lettering. Price **3/6**

BRAKE VAN
Finished in Grey, with opening doors. Obtainable with L.M.S. or G.W. lettering. Price **3/6**

JACOB'S BISCUIT VAN
Finished in crimson lake, with opening doors.
Price **3/6**

CARR'S BISCUIT VAN
Finished in blue, with opening doors.
Price **3/6**

***LUMBER WAGON No. 2**
Fitted with bolsters and stanchions for log transport. Suitable for 2-ft. radius rails only.
Price **4/-**
**Lettered L.M.S., L.N.E.R., G.W., or S.R.*

CRAWFORD'S BISCUIT VAN
Finished in red, with opening doors. Price **3/6**

SECCOTINE VAN
Beautifully finished in blue, with opening doors.
Price **3/6**

Manufactured by MECCANO LIMITED, BINNS ROAD, OLD SWAN, LIVERPOOL

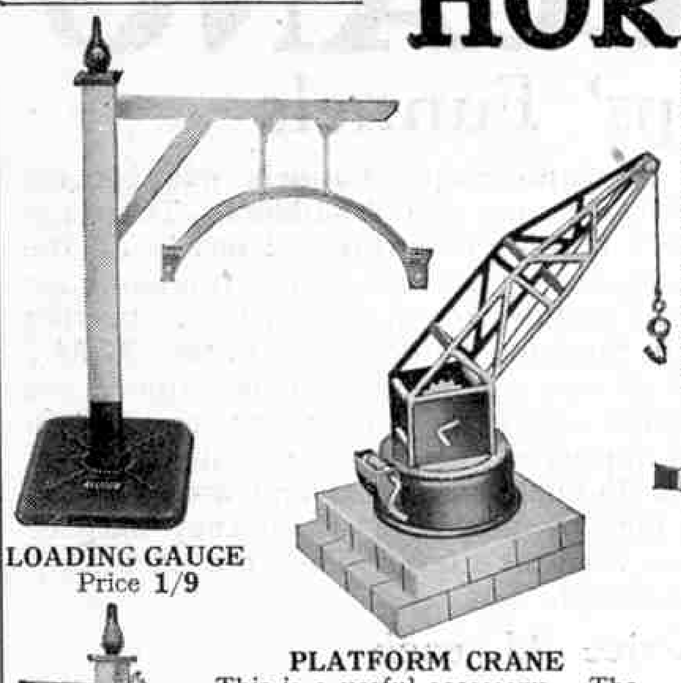
HORNBY SERIES

HORNBY ACCESSORIES

HORNBY SERIES

There is a splendid range of Hornby Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic Accessories the most elaborate model railway system may be constructed and operated in exactly the same manner as a real railway.

A selection of Hornby Accessories is illustrated below. Your dealer will be pleased to show you the full range.



LOADING GAUGE
Price **1/9**

PLATFORM CRANE
This is a useful accessory. The Crane revolves on its base and is fitted with a crank and ratchet mechanism for controlling the load. Price **4/-**

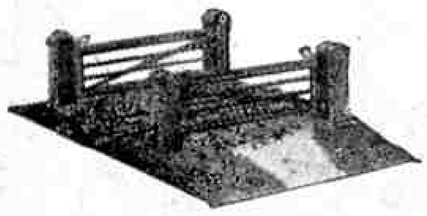
SIGNAL No. 1
Price **3/-** per pair. One "Home" and one "Distant."

RAILWAY ACCESSORIES No. 1
Miniature Luggage and Truck.
Price, per set **1/6**

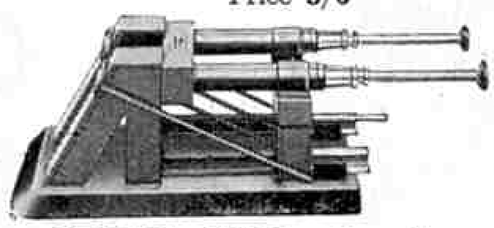
RAILWAY ACCESSORIES No. 3
Platform Machines, etc.
Price, per set **1/6**

RAILWAY ACCESSORIES No. 2
Milk Cans and Truck.
Price, per set **1/6**

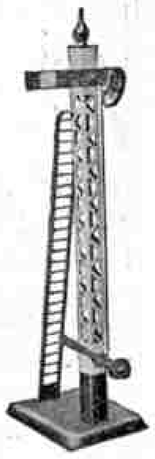
TELEGRAPH POLES
Price, per pair **3/6**



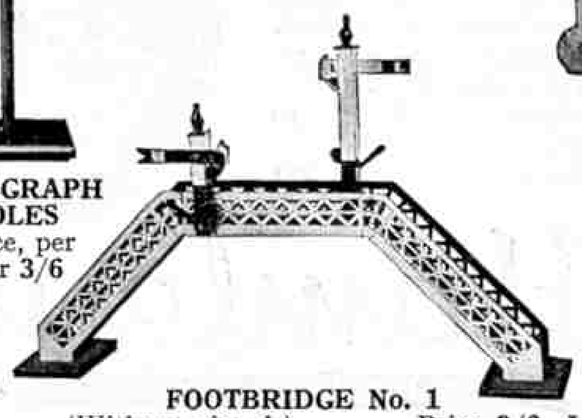
LEVEL CROSSING No. 1
This model is realistic in appearance and beautifully enamelled in colours. It is suitable for a single track only and has gauge 0 rails in position.
Price **3/6**



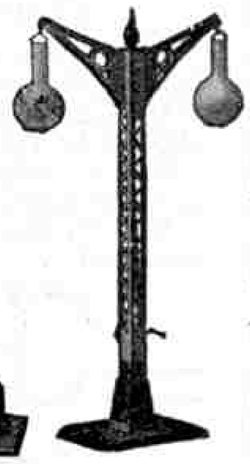
BUFFER STOPS No. 2 (HYDRAULIC)
Price **5/-**



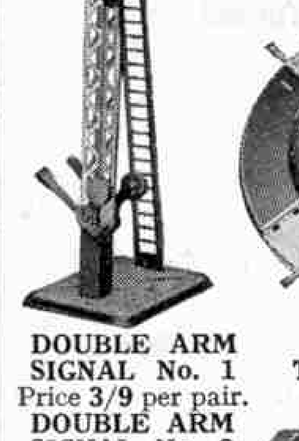
SIGNAL No. 2
Price **2/6** each.
"Home" or "Distant."



FOOTBRIDGE No. 1
(Without signals) ... Price **3/6**
FOOTBRIDGE No. 2
(As illustrated), complete with detachable signals Price **6/-**
Signals only, per pair **2/9**

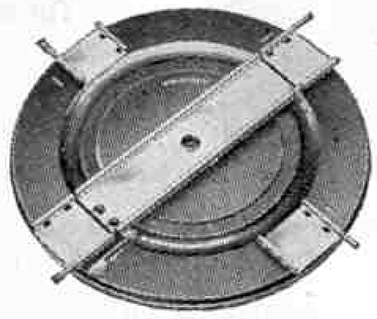


LAMP STANDARD No. 2 (DOUBLE)
Electric flash-lamp bulbs may be fitted into the globes.
Price **4/-**

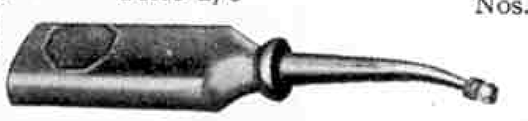


DOUBLE ARM SIGNAL No. 1
Price **3/9** per pair.

DOUBLE ARM SIGNAL No. 2
(As illustrated.)
Price **3/-** each.

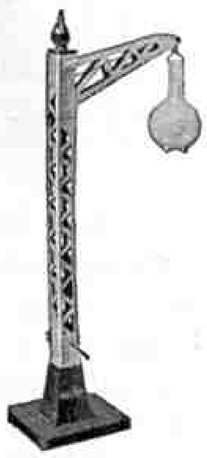


TURNTABLE No. 1
Price **2/6**

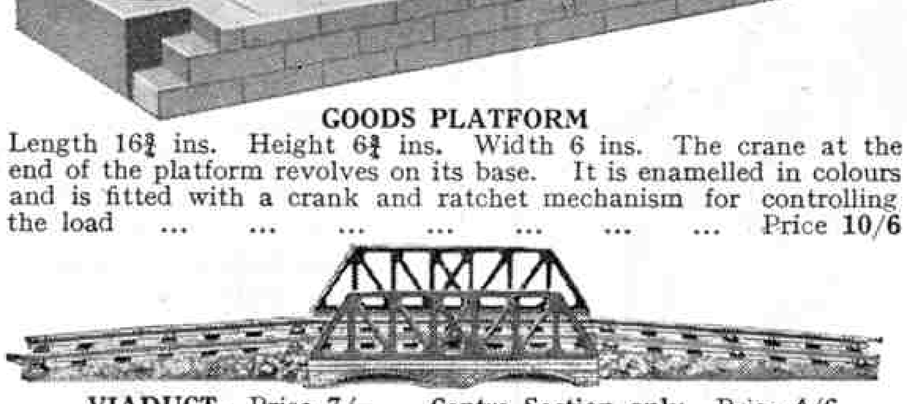


OIL CAN No. 1 (Ordinary Type)
This miniature Oil Can will give every satisfaction.
Price **6d.**

TARPAULIN SHEETS
Strongly made. Lettered L.M.S., N.E., G.W. or S.R. The above illustration shows one of the Tarpaulin Sheets fitted to a Hornby Wagon.
Price **6d.**

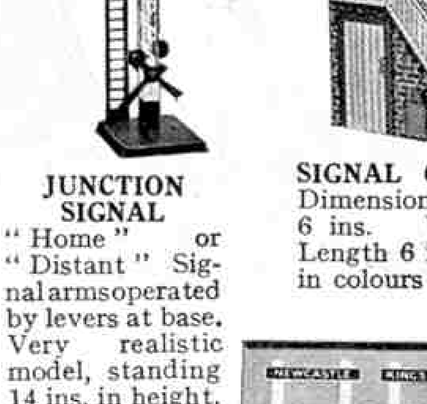


LAMP STANDARD No. 1 (SINGLE)
An electric flash-lamp bulb may be fitted into the globe. Price **3/-**



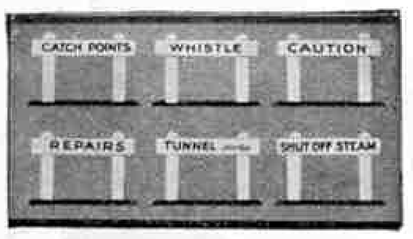
GOODS PLATFORM
Length 16¾ ins. Height 6¾ ins. Width 6 ins. The crane at the end of the platform revolves on its base. It is enamelled in colours and is fitted with a crank and ratchet mechanism for controlling the load ... ... Price **10/6**

VIADUCT. Price **7/-** **Centre Section only.** Price **4/6**
ELECTRICAL VIADUCT. Price **8/-**
Centre Section for Electrical Viaduct. Price **5/-**



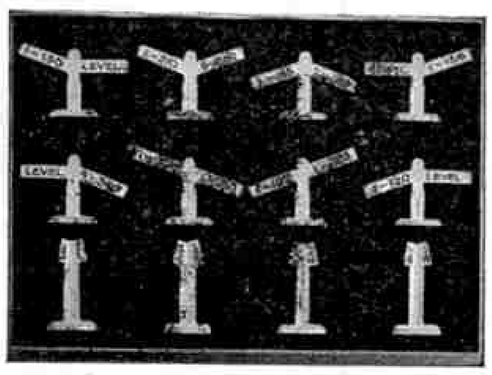
JUNCTION SIGNAL
"Home" or "Distant" Signal arms operated by levers at base. Very realistic model, standing 14 ins. in height.
Price **5/6**

SIGNAL CABIN No. 1
Dimensions: Height 6 ins. Width 4½ ins. Length 6 ins. Finished in colours ... Price **2/9**

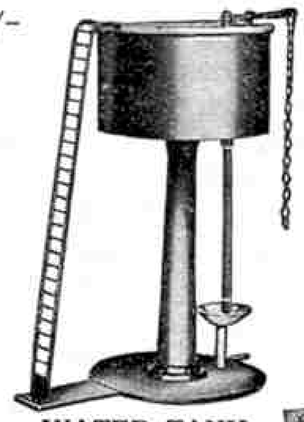


RAILWAY ACCESSORIES No. 8
Notice Boards.
Price, per set **2/3**

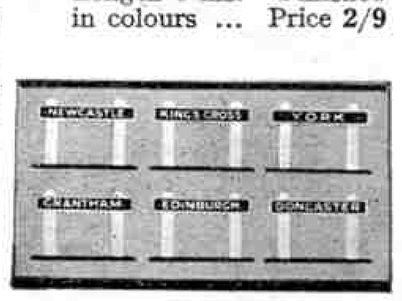
RAILWAY ACCESSORIES No. 7
Watchman's Hut, Brazier, Shovel and Poker ... Price **1/6**



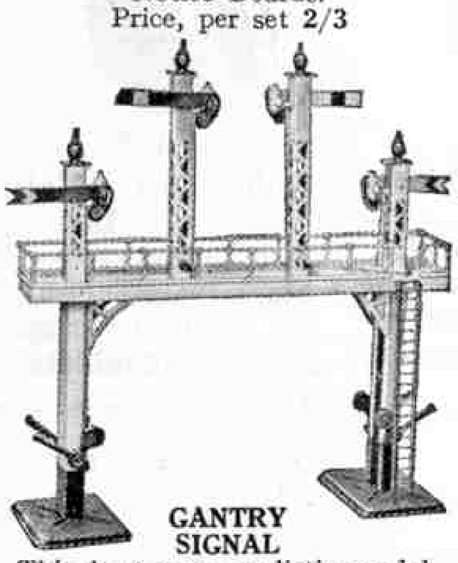
RAILWAY ACCESSORIES No. 5
Gradient Posts and Mile Posts. Price **2/-**



WATER TANK
Brightly coloured. Fitted with flexible tube and valve lever.
Price **6/6**

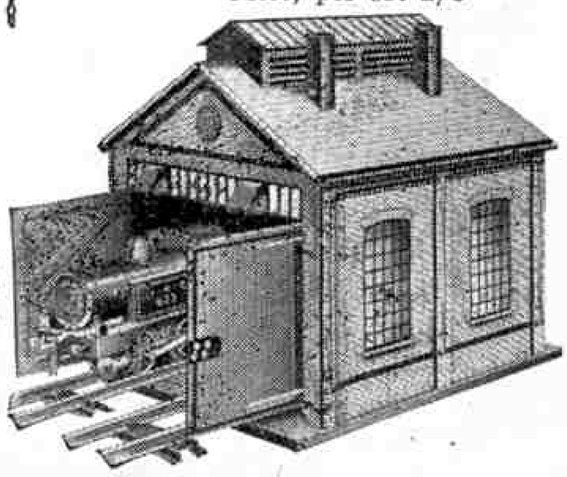


RAILWAY ACCESSORIES No. 9
Station Name Boards.
Price, per set **2/6**

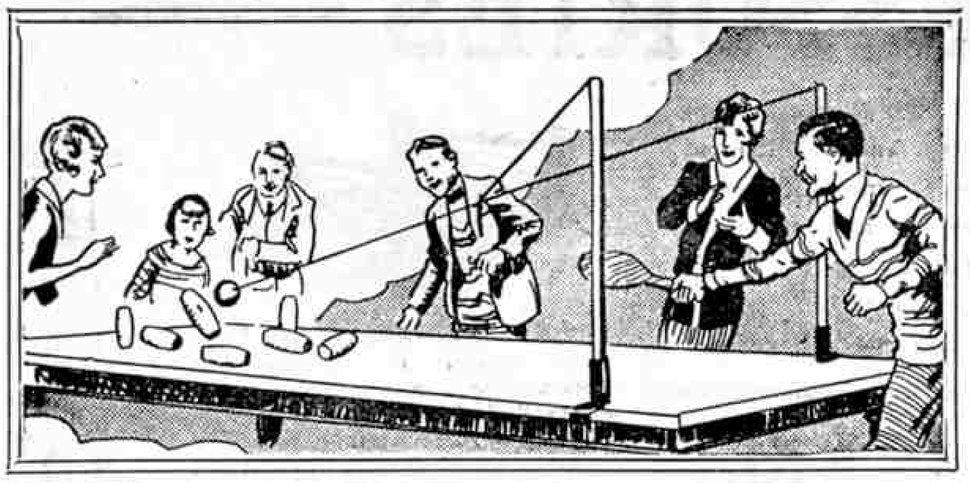


GANTRY SIGNAL
This is a very realistic model, the signal arms of which are operated by levers at the base of the standards. Attractively finished in colours. Price **10/-**

RAILWAY STATION No. 2. Excellent model, beautifully designed and finished. Constructed in three sections, which are detachable. Dimensions: Length 2 ft. 9 ins., breadth 6 ins., height 7 ins. ... ... Price **10/-**



ENGINE SHED No. 1
This Shed is beautifully finished in realistic colours. It will accommodate Locomotives and Tenders of the M series, No. 0 and No. 1 types ... Price **11/-**



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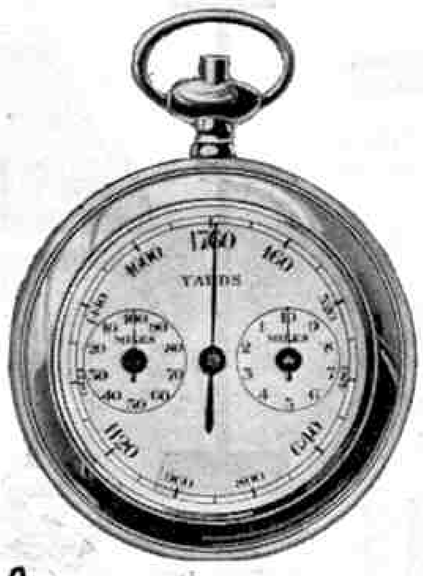
SKITTLE TENNIS

A fast and exciting game of skill for any number of players. Provides excellent practice for table and lawn tennis—ideal for parties. Price **12/6**



PEDOMETERS

For registering distance walked. Carried in the waistcoat pocket.

No. 2.—Registers up to 10, also up to 100 miles, **13/-**.

No. 3.—Registers yards, 1, 10 and 100 miles, **14/-**.

No. 4.—Registers 1 to 1,000 miles, **16/-**.

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Estd 1760
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Oxford Circus Tube Station (Booking Hall).

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FOR THE FAMILY

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No. 1.	5 Horses	**7/6**	All
No. 2.	8 Horses and longer Cloth ...	**10/6**	Carr.
No. 3.	12 Horses	**21/-**	Paid.

We specialise in Meccano and Hornby Trains and carry a full stock of all accessories.

WIGWAMS
create fine fun indoors or out of doors.
4 ft. 5 ft. 6 ft. 7 ft. high
7/6 17/6 21/- 27/6
Made from Strong Brown Canvas, gaily decorated.

INDIAN SUITS.
No. 1 No. 2 No. 3 No. 4
7/6 10/6 15/6 21/-
Each made in four different sizes.
No. 4 includes Spear and Tomahawk.

Send for 28 page Catalogue, Post Free.

W. HARRIS BRADLEY
53 & 54, VICTORIA ST., WOLVERHAMPTON

MECCANO
Ships' Funnels

The new range of Meccano Ships' Funnels has become extremely popular with Meccano model-builders. There are 25 funnels in the series representing those of nearly all the principal Shipping Companies. Eleven of the funnels have already been illustrated and described, four in the November 1929 issue and seven in the January 1930 issue of the "*M.M.*"

Details of a further group, composed of seven funnels, are given below. In some cases they represent more than one shipping line and the names of these are indicated.

The Meccano Ships' Funnels are raked and are provided with two perforated lugs by means of which they may be bolted to any Meccano Strip or Plate. They are all beautifully enamelled and finished.

Price 9d. each

138T
Canadian Pacific S.S. Co.

Buff funnel

Also representative of the following :—

Richard W. Jones & Co.
John Glynn & Son, Ltd.
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Garth Shipping Co. Ltd. (H. Clapham & Co. Ltd.).
Asiatic S.N. Co. Ltd.
Eastern Telegraph Co. Ltd.
Easton, Greig & Co.
New Zealand Shipping Co.

No. 138Y
Furness Line.
Black funnel. Broad red band round middle with narrow black and red bands immediately above.

No. 138A
Cunard S.S. Co.
Red funnel. Broad black band round top with three thin black bands round middle.

No. 138V
A. Coker & Co. Ltd.
Blue funnel. Broad black band at top with narrower white band below.

No. 138C
T. & J. Harrison. Black funnel. Red band flanked by two white bands.

Also representative of the following :—
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John Harrison Ltd.

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Manchester Liners Ltd.
Orange funnel. Broad black band at top and narrower black band round middle.

Also representative of the following :—
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No. 138S
Union Castle Mail S.S. Co. Ltd.
Red funnel. Broad black band round top with thin black band round middle.

Also representative of the following :—
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Obtainable from any Meccano dealer, price 9d., or direct from Meccano Ltd., Liverpool, price 10½d. post free.

MECCANO LTD., Old Swan, LIVERPOOL

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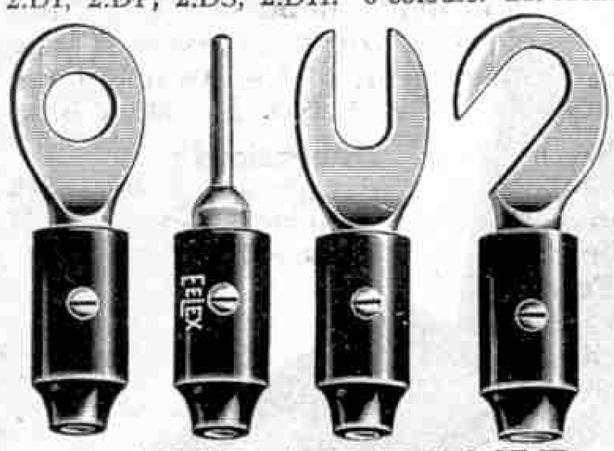
SPADES, PINS, HOOKS & EYES

2.DI, 2.DP, 2.DS, 2.DH. 6 colours. 2d. each.



A few of the accessories comprising the Eelex Standardisation System. Every one a standardised fitting and all parts interchangeable. By adopting this system the possibility of a wrong or accidental connection is minimised.

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MPS Series Plugs **4d.** each.
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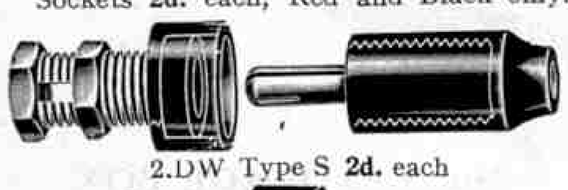

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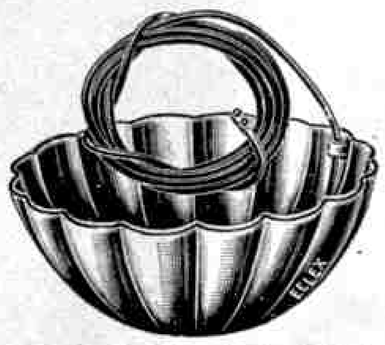

EELEX EARTH BOWL

Collects and retains all available moisture—improves with age—immune to atmospherical conditions—that is the Eelex "Earth." Supplied with 9 ft. of rubber-covered wire and connector for **5/6** each. Postage 9d. Write for list M29.

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Hair still smooth and glossy, giving an air of unruffled calm—its perfect set preserved by Anzora—a little on the hair in the morning. Use Anzora—the first perfect hair fixative—still the finest—and British.

ANZORA

MASTERS THE HAIR

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Cleaver

ENDLESS PLEASURE for WINTER NIGHTS

WITH A RILEY BILLIARD TABLE IN YOUR OWN HOME

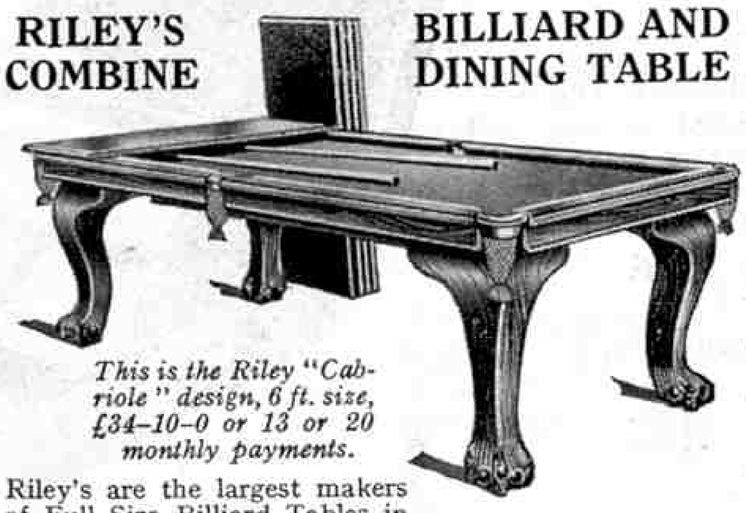
14/- **down brings you the 6 ft. Riley "Home" Billiard Table on seven days' Free Trial. Pay balance as you play. Cash Price £11–15–0. Riley's pay carriage and take transit risks.**

Let a Riley Table banish winter evening dullness from the home. Your family and friends will revel in the enjoyment it brings. Riley's "Home" Billiard Table rests on an ordinary dining table. There is one to fit your table. Cash or easy payment prices, in sizes as below.

4 ft. 4 in. × 2 ft. 4 in.	...	£7	0	0	*or in*	8/6
5 ft. 4 in. × 2 ft. 10 in.	...	£9	0	0	*18*	11/-
6 ft. 4 in. × 3 ft. 4 in.	...	£11	15	0	*monthly*	14/-
7 ft. 4 in. × 3 ft. 10 in.	...	£15	0	0	*payments*	18/-
8 ft. 4 in. × 4 ft. 4 in.	...	£21	10	0	*of*	26/-

WRITE TO-DAY FOR FREE ART LIST

RILEY'S COMBINE BILLIARD AND DINING TABLE



This is the Riley "Cabriole" design, 6 ft. size, £34–10–0 or 13 or 20 monthly payments.

A beautiful piece of furniture and a matchless Billiard Table. In many attractive designs. Oak or mahogany.

Also offered on cash or easy payment terms. These are the prices for the round leg mahogany tables.

5 ft. 4 in. × 2 ft. 10 in. **£22 10 0**
6 ft. 4 in. × 3 ft. 4 in. **£26 10 0**
7 ft. 4 in. × 3 ft. 10 in. **£33 0 0**
8 ft. 4 in. × 4 ft. 4 in. **£43 0 0**

or in 13 or 20 monthly payments.

Riley's are the largest makers of Full Size Billiard Tables in Great Britain.

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A Book for Every Railway Enthusiast

200 pages
and 58
illustrations

Price 2/6
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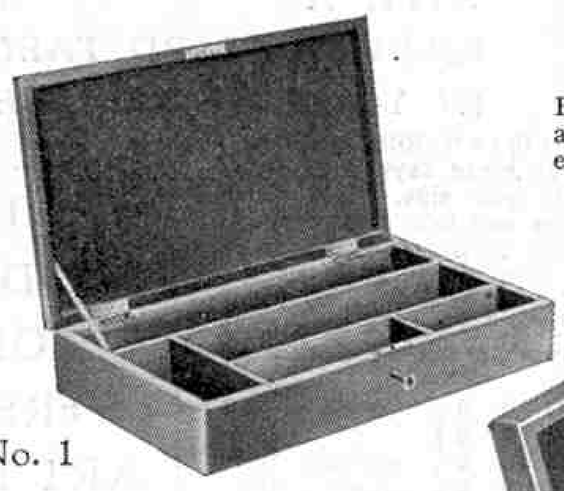
This book tells the story of some of the most famous expresses of Great Britain. The author, Mr. Cecil J. Allen, is one of the best-known writers on railway matters, and his lectures and B.B.C. talks are always popular. His present contribution will be of great interest to all who are interested in railways. The Book is beautifully printed on art paper, cloth bound, and is fully illustrated throughout. It may be obtained from any Meccano dealer or any newsagent, price 2/6, or direct from Meccano Ltd., Old Swan, Liverpool, price 2/9 (post free).

MECCANO LTD. (Dept. AC.), Old Swan, LIVERPOOL

Storage Boxes for Meccano Parts

Almost every Meccano boy purchases additional Meccano parts from time to time, but there is sometimes difficulty in finding suitable accommodation for them. We supply strongly made boxes that have been specially designed for the purpose, enabling such extra parts to be stored neatly and methodically so that they are always easily accessible. There are three different sizes, each of which is illustrated and described below.



No. 1

No. 1 STORAGE BOX

Attractively enamelled in red, and fitted with partitions as shown n the illustration. The lid is hinged and is secured by means of lock and key.

Price 10/6

Dimensions

Length 15½ ins.
Width 8¾ ins.
Depth 2¾ ins.

No. 2 STORAGE BOX

Finished as No. 1 Box and provided with ock and key. The tray with which it is fitted enables a much larger quantity of parts to be accommodated.

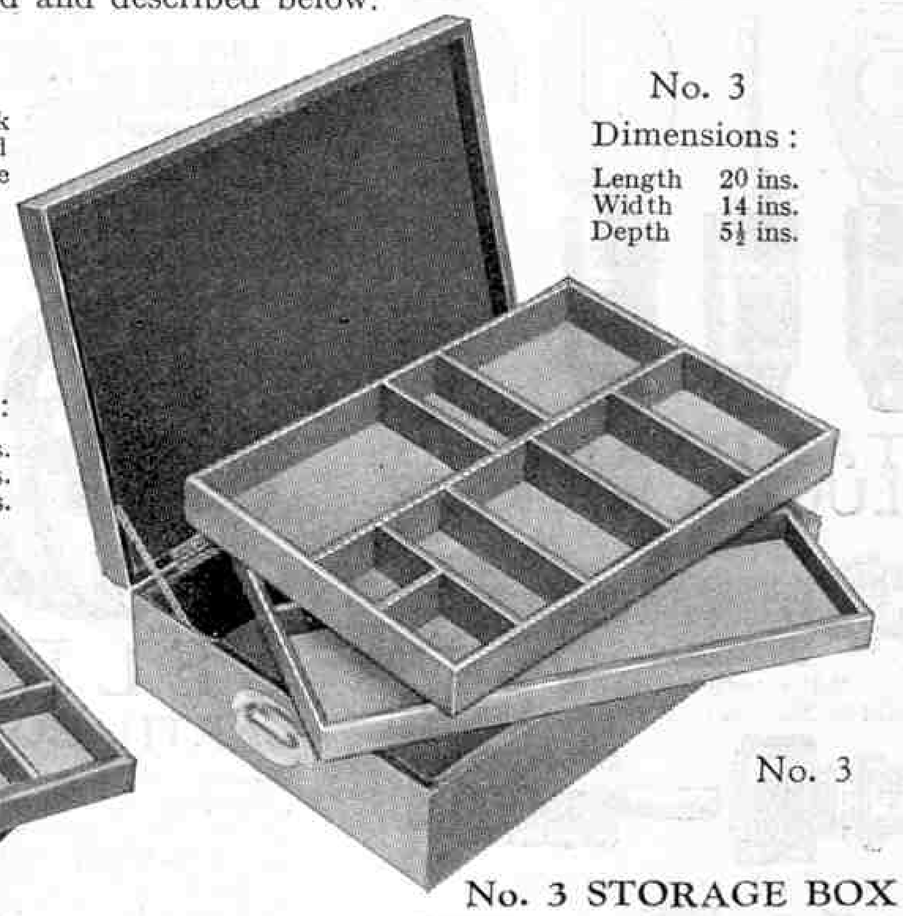
Price 21/-

No. 2

Dimensions :

Length 14½ ins.
Width 11 ins.
Depth 3¾ ins.

No. 2



No. 3

Dimensions :

Length 20 ins.
Width 14 ins.
Depth 5½ ins.

No. 3 STORAGE BOX

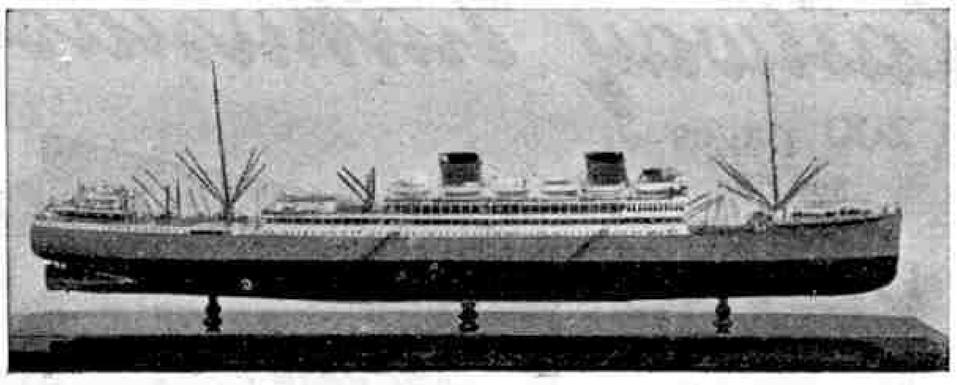
A perfect receptacle for Meccano parts. Finished similarly to the No. 1 and No. 2 boxes and provided with lock and key. Fitted with two partitioned trays.

Price 30/-

MECCANO LIMITED, Binns Road, Old Swan, LIVERPOOL

BRITISH-MADE

MODEL BOATS



Scale Model of M.V. "CARNARVON CASTLE."

SCALE MODEL DESTROYER. "No. D.36," fitted with efficient modern steam plant. Price **£10 10s. 0d.**

NEW MODEL LINER. Steam driven in either White Star, Cunard, Union Castle, or R.M.S.P. colours. Price **£13 13s. 0d.**

MODEL MOTOR BOAT "MERCURY," with clockwork mechanism. Price **£1 10s. 0d.** Electric pattern, motor working off pocket dry battery. Price **£1 15s. 0d.**

MODEL STEAM MOTOR BOAT "DIXIE." Price **15s. 6d.**

Other Sailing Yachts and Power Boats, Ships' Fittings and everything for the model ship-builder are described in our catalogue section S/17, post free 6d.

Catalogue No. 17. MODEL RAILWAYS and ACCESSORIES, Castings, Fittings and Parts for Model Makers. Over 300 pp., post free 1/-.

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The Famous **"SKISAIL"** range of models

The Finest Flyers yet Produced

The Best Obtainable. British Made and Guaranteed

Provisionally Protected No. 23533.
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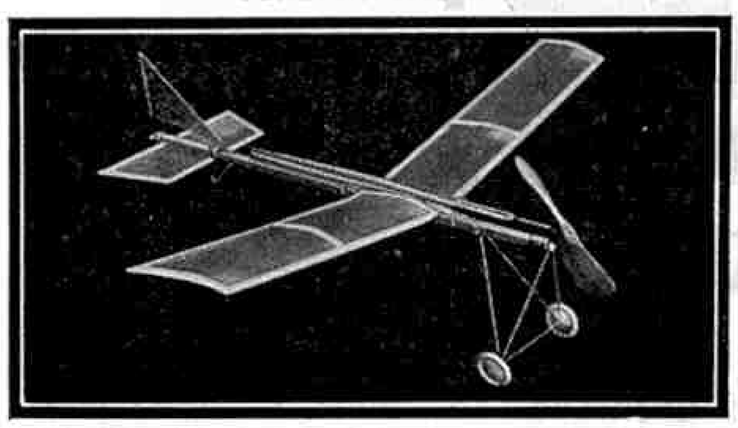


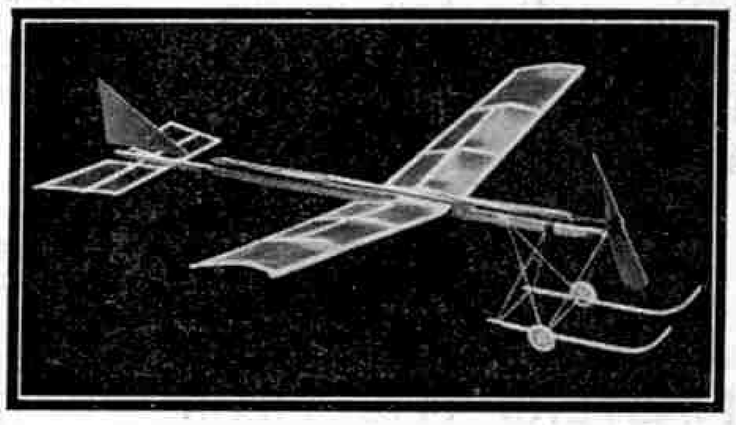
OUR FAMOUS Nos. 4 & 5, as illustrated, fitted with **8" Hand-carved and Balanced Propeller,** is the largest and best value model on the market. Wing Span 21 in. and 23½ in. Constructed of highest quality material and workmanship. **Perfect flight guaranteed. Unrivalled in the British Market.**

4/6 and 6/6
Postage 6d.

SPECIFICATION. Hand-carved Propeller, Proofed Silk Planes, Aluminium Wheels, Nos. 0, 1, 2 fitted with our Famous Patent Safety Chassis with Bamboo Runners.

OUR No. 0 MODEL as illustrated. Patent No. 138210. Wing Span, 32 ins. A splendid flyer and an ideal gift. Fitted with **Our Famous Patent Safety Chassis with Bamboo Runner.** Hand-carved Propeller.

Price 18/6
Postage 6d.
Model de Luxe 27/6



Prices { No. 0 Price **18/6** No. 2 Price **10/6** No. 4 Price **6/6**
„ 1 „ **14/6** „ 3 „ **8/6** „ 5 „ **4/6**

The "SKISAIL" monoplanes are designed by an aeronautical expert and all models are fitted with **Polished Hand-carved Balanced Propellers.**

Send P.O. to **PATENT MODEL MANUFACTURERS**

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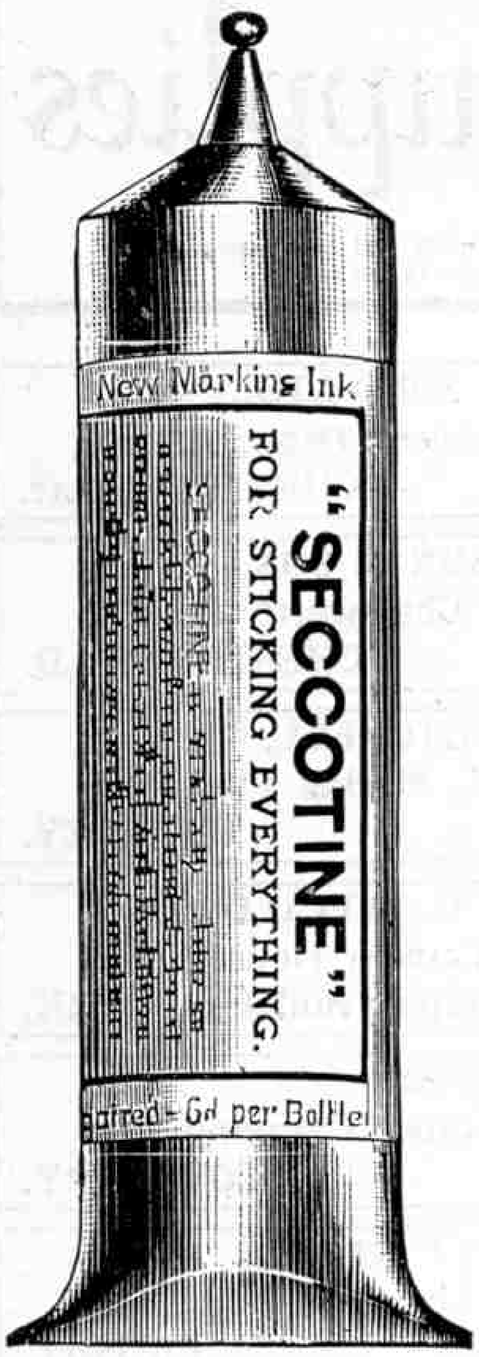


THE MECCANO BOY'S STAND-BY

THE TUBE OF

SECCOTINE

The World's Great Adhesive. Registered Trade Mark.

WITH it he can mend a thousand things—his bats, balls, boats, boxes, bags, books, &c. He can make numberless things that a boy likes. He can help his mother by mending breakages in house furniture, anything—everything.

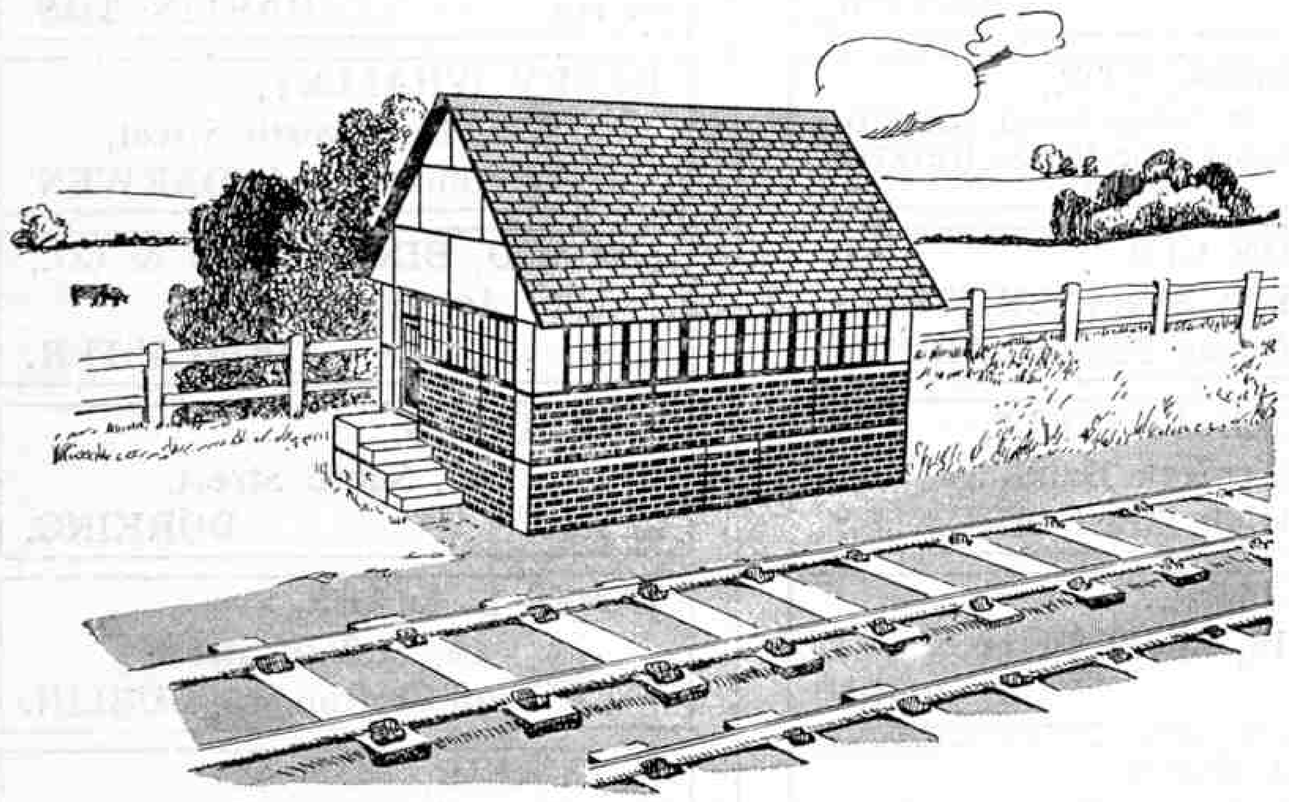
NOTE. There is nothing messy about Seccotine. Use the spike or pin supplied to open a new tube—at top of cone—press gently at end of tube (at folded part) for as much adhesive as is needed—then replace spike or pin which acts as stopper. Keep folding tube end as contents are withdrawn. Give mended article adequate time for drying.

TUBES are 4½d. (vest pocket box), 6d. and 9d. each. Sold everywhere.

Mothers should know that cups, saucers, tumblers, etc., intended to hold liquids, hot or cold—should be mended with FIRMAS (Heat Seccotine). Tubes 6d. each.

McCAW, STEVENSON & ORR LTD.

The Linenhall Works BELFAST



Boys! Build This Signal Box

FOR YOURSELF WITH

LODOMO

The New Stone Building Bricks Made by LOTT'S BRICKS LTD.

Each Box is complete with Bricks, Roofs, and Plans in Colours for the number of models stated.

Box 1 18 models 3′6 **Box 2** 50 models 7′6

Box 3 72 models 12′6

The Signal Box shown above is built with No. 3 Lodomo and is one of the 72 models from this box. This number includes Goods Sheds, Railway Stations, Farm Buildings, Market Hall, Country House, Wayside Inn, Petrol Filling Station, etc., etc., all in bright realistic colours.

Send a postcard to-day for your FREE copy of the latest book of Lott's Bricks, beautifully illustrated in colours. It tells all about the many wonderful buildings you can make with these stone bricks.

LOTT'S BRICKS LTD., WATFORD, ENGLAND.

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B. Blewett, NEWTON ABBOT.
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All the dealers whose advertisements appear on the following three pages carry full stocks of Meccano Outfits, Accessory Outfits and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

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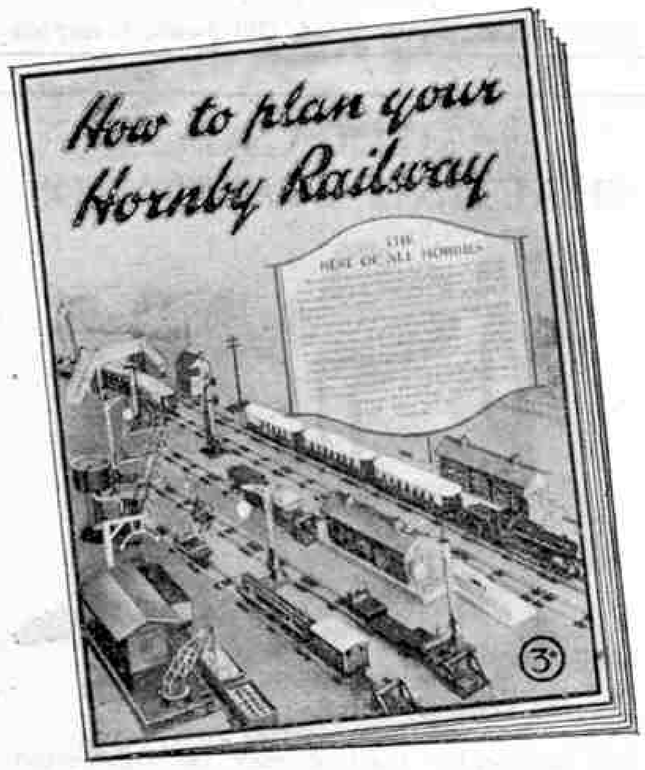

Every owner of a Hornby Train should have a copy of this splendid new book, for it contains much useful information concerning miniature railways. All enthusiasts will find it of great assistance in enabling them to obtain the utmost pleasure and satisfaction from their hobby.

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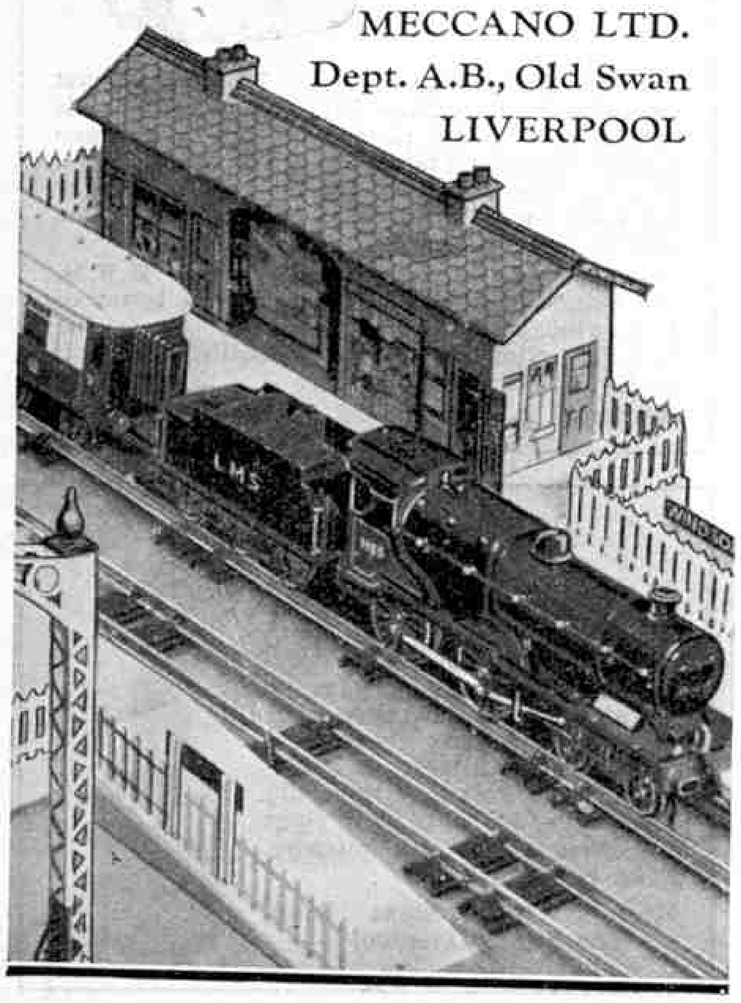

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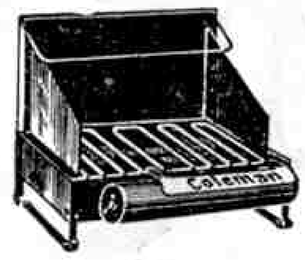

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Christmas Charity Stamps—(*Cont. from page 163*)

The Menin Gate design alone is enough to commend the issue to British collectors, but the whole series is well produced and, unquestionably, will command a big measure of popularity.

Austria alone among the regular Christmas charity stamp issuing countries has given its printing machines a rest this year, but the Nibelung series, with which we dealt in detail in the "*M.M.*" for March last, remains available for charitable purposes.

In the early part of November, however, Austria issued a general series, designed to draw the attention of tourists to the many beautiful places that abound throughout the country. The set contains 10 values, and features several places that have not previously been distinguished by employment in an Austrian stamp design. In the space available this month we cannot devote more than a passing reference to this set, and we will return to it at a later date.

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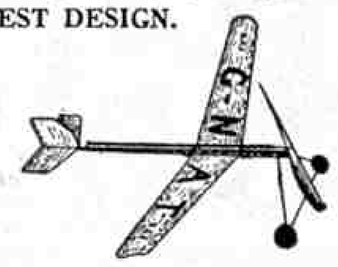

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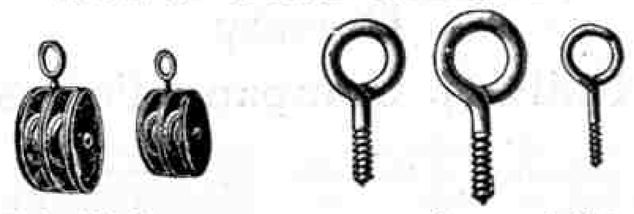

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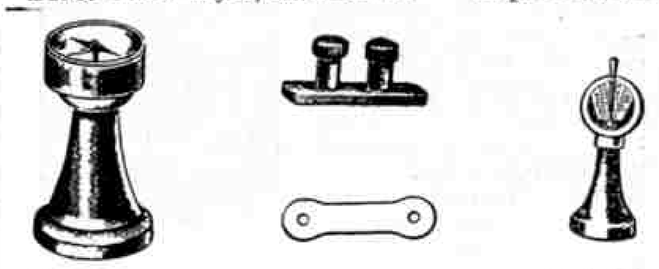

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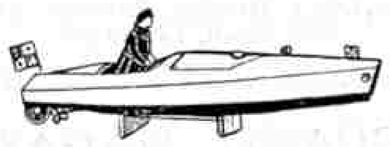

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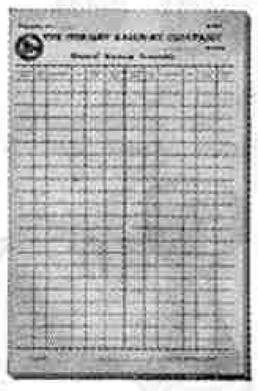

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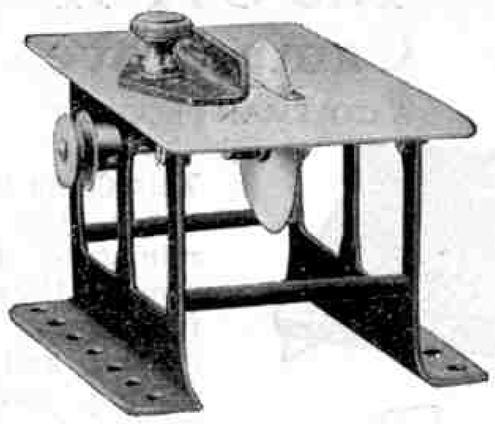

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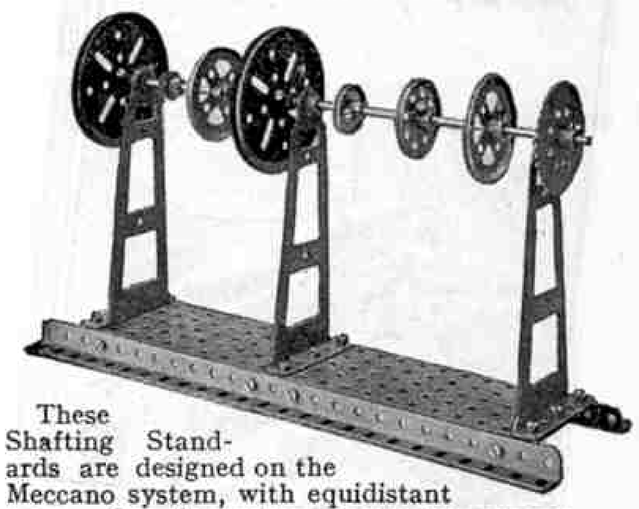
Meccano enamel has been introduced to enable model-builders to convert nickel parts to colour or to touch up coloured parts should such treatment become necessary through mishandling. It is available in red, grey and green, each colour being identical in shade with the enamels used in the Meccano Factory for spraying Meccano parts.

Price per tin 8d.

Meccano Ltd., Binns Road, Old Swan, Liverpool

MECCANO SHAFTING STANDARDS



These Shafting Standards are designed on the Meccano system, with equidistant holes. Our illustration shows how strong and serviceable shafting may be constructed from Meccano parts with the aid of the Large Standard.

Standard only, Large ... ... Price 1/-
„ „ Small ... ... „ 8d.

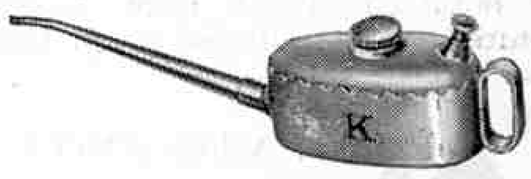
Meccano Ltd., Binns Road, Old Swan, Liverpool

OIL CAN No. 1 (Ordinary Type)

This miniature Oil Can will give every satisfaction. It may be used for general purposes but it is particularly suitable for oiling Meccano Models and Hornby Trains. Price 6d.

Meccano Ltd., Binns Road, Old Swan, Liverpool

OIL CAN No. 2 ("K" Type)



Every Meccano and Hornby Train enthusiast should add a miniature "K" type oil can to his equipment for the purpose of oiling Meccano models, Hornby Trains, etc. The oil is ejected drop by drop by depressing the valve, as in the full-sized model, and in all other respects the oiler is perfect.

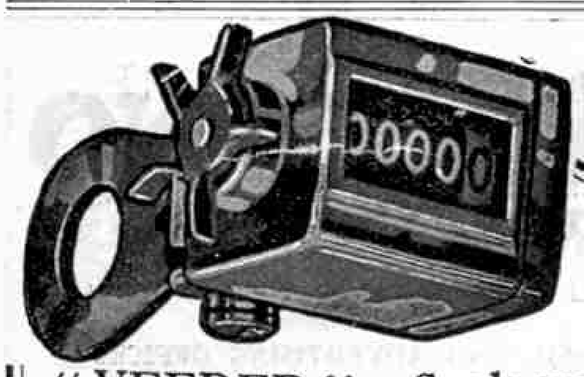
One of the oil cans was sent to H.R.H. the Prince of Wales, and a gracious letter of acknowledgment was received expressing H.R.H.'s admiration of the beautiful lines and perfect finish of this model. Price 3/6.

Meccano Ltd., Binns Road, Old Swan, Liverpool

MECCANO LUBRICATING OIL

Before commencing to operate a Meccano model, or to run a Hornby Train, all gears and bearings should be oiled thoroughly with Meccano Lubricating Oil. This oil is specially prepared and is of the right consistency for the purpose. Price per bottle 6d.

Meccano Ltd., Binns Road, Old Swan, Liverpool



"VEEDER" Cyclometers

Cycling without a **VEEDER** is like living without a Watch. You cannot do one or the other intelligently.

A VEEDER tells you :—
How far you have been.
Distance from one place to another.
Service your tyres give you.
Number of miles to destination.
Total season's travel, etc.

INSIST UPON A GENUINE VEEDER
(See the name thereon).

Obtainable from all important Cycle Dealers. Made in two Models : Regular 6/6, Trip 15/-

Send for Illustrated Booklet to :—
F. E. DICKINSON,
St. Andrew's House, Holborn Circus, London, E.C.1.

SAFETY PISTOLS AND REVOLVERS

Can be bought, sold and carried without permit of any kind (except INDIA).

PISTOLS.

No. 54. Small Nickel Pistol with extractor and cartridge cover, solid barrel and top vent holes 1/11
No. 85. Medium size, heavier model, nickel as above 2/6
No. 21. Long barrel, 8" over all, nickel finish, etc. 3/-

REVOLVERS.

No. 286. 6 Chamber, Blue or Nickel solid barrel, top vent holes, perfectly sound and fool proof 6/11
No. 055. 8 Chamber Blue or Nickel, heavier pattern, solid frame 9/11
No. 685. New Model with safety catch, heavy constabulary pattern with trigger guard, 10 chamber, nickel or blue ... 17/6
No. 287. Safety Automatic Pistol, 6 shot magazine, blue finish, latest model ... 12/6
No. 123. Dolla Air Pistol as illustrated 5/-
BLANK CARTRIDGES. 50, 9d. ; 100, 1/3

Postage on Each 6d. extra.
Cartridges, Carriage 9d. per 100 miles.
H. H. Parson (Pistol Dept.), 55, Northcote Rd., S.W.11

The nicest and best of all sweets is

Callard & Bowser's
Celebrated "THISTLE"
Butter-Scotch

All good confectioners sell it

6d. ¼lb. packets and larger

"The Knight," Part I, 3d., postage ½d. Articles from various Public and Private Schools.—Editor, 19, Frenchay Road, Weston-super-Mare.

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FOR
SCOUTS & GUIDES

The Complete Results of our recent Plasticine Competition in Booklet Form, with a foreword by the Chief Scout.

This booklet is of absorbing interest to all Young People. It is written almost entirely by Scouts and Guides and shows what can be done with Plasticine, not only as a Plaything, but as a material of real

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Price 3d., or Post Free 4d., from

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Postage and Packing 1/- extra.
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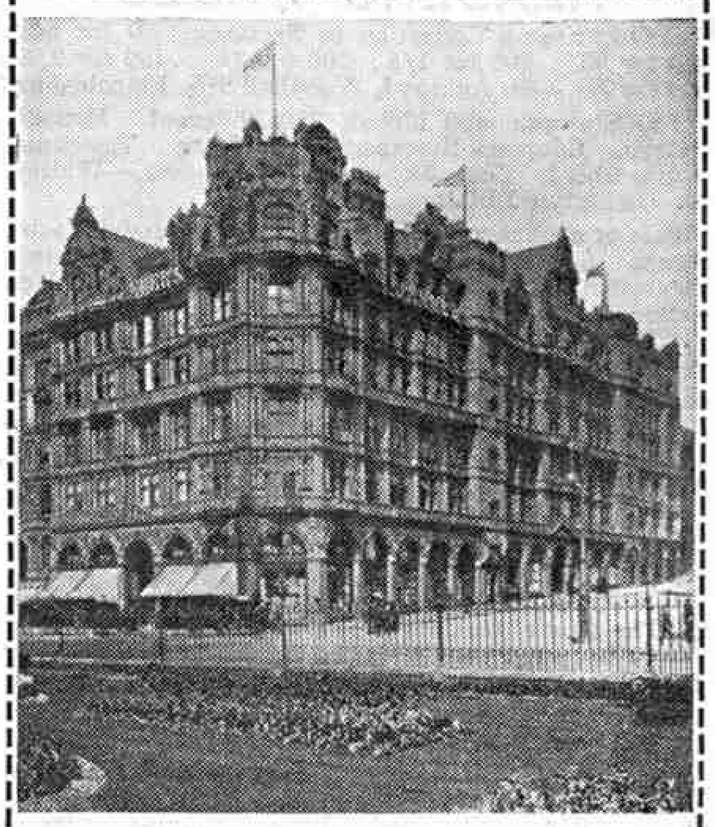
DON'T BE BULLIED

Learn to take care of yourself under **ALL** circumstances without weapons by absolutely the **BEST** self-defence ever invented, namely **JUJITSU**, the wonderful Japanese art. Easy to learn Send two penny stamps for **SPLENDID ILLUSTRATED LESSONS** and particulars. **PRACTICAL TUITION** in London daily.
"YAWARA" (Dept. M.C.),
10, Queensway, Hanworth, Feltham, Middx.



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A complete stock of all Hornby Train Accessories and Meccano Parts.

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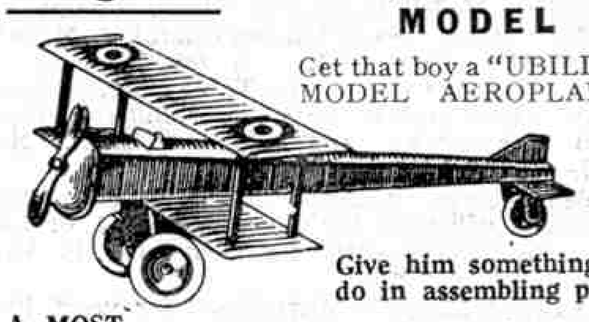
Bargain !

AEROPLANE MODEL

Get that boy a "UBILDA" MODEL AEROPLANE



Give him something to do in assembling parts

A MOST INSTRUCTIVE TOY

Also supplied in
Motor Cars 3/9,
Trains 3/3, *post paid*

Price, Post Paid
2/3

Loxley Bros. Ltd.
DEPT. MM **Sheffield**

THE BOAT for the BATH 3/11
IT'S AN "ABBEY" TOY

Instant Acceleration !

Runs 15 minutes without attention.
HOT AIR DRIVE from "Meta," Spirit, Candle-end, or even Night Light. No clock work. No battery. No boiler. Nothing to explode ! 9 ins. long. Draught 2 ins. Rudder.
Continuous "Toc-Toc" heard for great distance.
Write for name of nearest agent, or 4/5 post free (Overseas 5/-), from
ABBEY SPORTS CO. LTD. (Dept. M.C.), 125, Borough High Street, London, S.E.1.

Other Special Lines from "ABBEY"

CLICO POTATO PISTOL
SURESHOT GUN
CLASS "T" BOAT
SILENT TRAIL
SINGLES CHAMPION
and the
CRAZY STUNTER

READERS' SALES

Selling Stamp Collection in Sections: 50 for 5d.; 100 for 9d.; 200 for 1/5; 300 for 2/–; 400 for 2/6; 500 for 3/–.—H. Ackroyd, Woodhall Spa, Lincolnshire.

750 Stamps. 400 Mixed, 350 Different. Monaco, Belgian Coupon Stamps, Luxemburg, Tasmania, Wurtemberg. Cost 35/–. 15/– or offers.—Widley, 89, Ossington Buildings, W.1.

Sale or exchange for strong Air Gun; Model Yacht, Steam Locomotive, Conjuring Tricks, Kliptiko, Cigarette Cards. What offers? Write for particulars. —Box 901.

Sale. Blank Cartridge Automatic, cost 12/6, 7/–. Powerful Air Pistol, cost 19/–, 13/–. Both excellent condition.—J. Hawkins, 71, Botley Road, Oxford.

Sale. "Meccano Magazines," June 1926-February 1929. Good condition. Best offer secures.—Lakeman, 33, Coleridge Walk, Golders Green, London.

1,000 Postage Stamps, all different, 10/–; also Bunsen Burner.—Wilkin, Ivatt Street, Cottenham, Cambs.

"M.M.'s," 1928, good condition, sell 2/6.—Walker, 27, The Grove, Golders Green, London, N.W.11.

Sale. 5,000 Cigarette Pictures, including 20 Sets of 50, also Album containing 1,000 different Stamps. Offers?—T. Thacker, Mansion Buildings, Bishops Itchington, Leamington Spa.

Bowman 234 Loco, 17/6; Tender, 4/9; Bowman Tank 300, 12/–; Bowman Stationary Engine 101, 19/6. All carefully used. Perfect running order.—Mayes, Worthing, Elmham, Norfolk.

Guinea Erector Set, new Xmas 1929. Best offer over 12/–.—Webb, Hill Crest, Penns Lane, Erdington.

Sale. Yacht. Length 54 ins., 30/–. Electric Motor and Transformer, cost £2. Bargain, £1.—274, Harborne Park Road, Birmingham.

Sale. 2,450 Clean Cigarette Cards, comprising 1,775 in sets, 675 odd. Albums included. 30/– or near offer.—F. Gale, c/o Holliday, 71, Herne Hill, S.E.24.

Sale. Gauge 0 Clockwork Railway. Two 0–6–0T Locos with variable speed, will negotiate 2 ft. radius. 4–4–2T Loco, five Passenger and eight Goods Vehicles. Over 100 ft. track. All leading makes. Cost £12. Sell £3 or nearest.—Curdy, Marula, Plumpton, Sussex.

Sale. Gibbons Stamp Monthly, Vol. 1, unbound. "The Stamp Lover," Vols. 20-21, unbound; 30 "Hobbies," and 15 "Handicrafts," all with designs. Offers.—50, Linden Gardens, Chiswick.

Sale. Birds' Eggs. Stamp for List.—Fellows, The Rocks, Hurst Hill, Bilston.

"Meccano Magazines" for sale. Excellent condition. Offers.—Petrie, 6, Gowan Street, Arbroath.

Sale. Bassett-Lowke Clockwork Tank Loco, cost £3/15/–. Steam Loco, excellent running order, also Brass Vertical Boiler with Lamp, 18 ft. scale Track. Lot £3/10/–. (Gauge 0).—Channer, Hallwood, Cranbrook, Kent.

Wireless Set, Earphones, Aerial Flex, etc. Cost £2/4/–. First offer above £1.—2, Fairholme Avenue, Gidea Park, Romford.

For Sale. Model Horizontal Steam Engine and Boiler, by "Stuart Turner," in new condition. Mounted on baseboard. Cost £6/10/– a few months ago. Offers, or exchange for Electric Table Bing, 00 Gauge Railway. Also, Riley Slate Bed Billiard Table, complete accessories and Snooker Balls. New. Offers?—Greaves, The Lodge, Brookwood.

Foreign Stamps. Collector having large quantity of duplicates will send 500 different for 1/4, or 1,000 different for 2/8, excellent for beginners.—B. Vant, 4, Clifford Avenue, Hull.

For Sale. "Meccano Magazines" for years 1924-25-26-27. Best offer secures.—C. Miller, River Wyre Hotel, Poulton-le-Fylde.

Sale. Seven volumes "Boys' Own Paper." Stamps —British Colonials—on approval.—P. Pritchard, 74, Stamfordham Drive, Allerton, Liverpool.

For Sale. Adana Baby Printing Machine, also additional accessories. Stamp for particulars.—G. Kay, 100, Akerman Road, London, S.W.9.

For Sale. 34/– Bowman Steam Engine. Will take 25/–. New Electric Miniature Railway, 25/–.—H. D. Reed, 37, Sheepcote Road, Harrow.

Cigarette Cards. Please send for Price List.—Thornton, 159, Grosvenor Road, Wavertree, Liverpool.

Sale. Vertical Steam Engine, cost 12/6. Also two-valve Marconi Wireless and one-valve Amplifier with Valves and Battery. Cost £35. What offers?—Walden, 5, High Street, Andover.

Sale. Wormar Steam Engine. Cost 10/6. Sell 5/–. In Running Order. 2,600 Cigarette Cards, Sets and Mixed 5/–. Will exchange both for Boat.—Rawlins Garage, Avebury, Marlborough, Wilts.

Wanted. "M.M.'s," May, 1925. Twelve issues of 1923. Will give 5d. per copy.—N. Curry, Windsor, Nova Scotia, Canada. P.O. Box 25.

Sale. "M.M.'s," Nov. 1926–Jan. 1929, except June and Aug. 1927. 5/–. "Auto's," 1494–1514, 2/–. 247 diff. Match Box Tops, 5/–. Cigarette Cards, 6d. 50.—Thomson, "Eversley," Albert Road, Grappenhall, Warrington.

"M.M.'s," 1926, '27, '28; 14 others; 350 "Scouts"; 80 "Modern Boys"; "Hornby Train Books," 1925, '26, '27, '28, '29; "Meccano Book of Engineering"; Health, Science, Adventure Magazines, etc. Offers.—D. Mackinnon, 68, Ardencaple Quadrant, Helensburgh, N.B.

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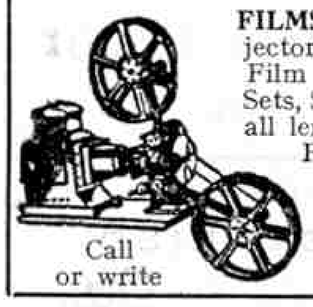
RAILWAY PHOTOGRAPHS.
New L.N.E.R. & L.M.S. High-Pressure Locomotives, 6d. the pair, post free.
Send 4d. for List M7 and specimen photograph.
All photographs post card size, 3d. each, 2/6 doz.
Railway Photographs, 23, Hanover St., Liverpool.

"Simplex Typewriter," cost 20/-, sell 14/-; "Bowman Engine," 32/6, sell 24/- or nearest. Both new.—Thomas, Wesley Manse, Abercynon, Glam.

BOYS MAKE YOUR OWN LEAD SOLDIERS
Cowboys, Indians, Animals, Zulus, Model Farmyard Sets, Rodeo, etc. Our CASTING MOULDS make thousands from any scrap lead WITHOUT PREVIOUS EXPERIENCE. Send stamp to-day for Illustrated Catalogue. Complete mould ready for work 2/6.—**"TOYMOULDS," 67, Stafford Street, Birmingham.**
"Mention Meccano."

HOME CINEMATOGRAPHS

Call or write
FILMS AND ACCESSORIES. Projectors at all prices from 5/– to £16. Film Spools, Rewinders, Lighting Sets, Screens, Sprockets, etc. Films all lengths and subjects. Sample Film 1/– and 2/6, post free.
Illustrated Lists Free.
FORD'S (Dept. M), 276/7, HIGH HOLBORN, LONDON, W C.1.

HOME CINEMATOGRAPHS
Latest Models all prices from 3/6.
Films and Accessories.
Sample Films, 1/- post free.
Price List Free.
The Mechanical Supply Company, 11, Churchfield Avenue, London, N.12.

AIRCRAFT APPRENTICES
600 vacancies are now available for boys of good education (between 15 and 17 years of age on August 1st, 1930) for training as skilled craftsmen. Good training, pay and prospects. Examination at local centres. Full particulars from Royal Air Force (Aircraft Apprentices' Dept. M.E.), Gwydyr House, Whitehall, London, S.W.1.

CINEMATOGRAPHS British Made from **37/6**
CINEMATOGRAPH FILMS
from **5/-** per 1,000 ft.
Write for our Catalogue, post free, or send 1/– for sample length of Film and Catalogue.
Filmeries Co., 57, Lancaster Rd., Leytonstone, E.11

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICES:—
OLD SWAN, LIVERPOOL, ENGLAND.
Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/–. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Small Advertisements. 1/6 per line (average seven words to the line), or 16/– per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

Press Day, etc. Copy should be sent as arly in the month as possible for insertion in following issue. We usually close for press on or before 6th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

Ordering the "M.M." Overseas

Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/2 per copy (postage extra), and the subscription rates 8/– for six months and 16/– for 12 months (post free); Canada, where the price is 15c. per copy, and the subscription rates 75c. for six months, and $1.50 for 12 months (post free).

The U.S.A. price is 15c. per copy, and the subscription rates 90c. and $1.75 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

CANADA: Meccano Ltd., 34, St. Patrick St., Toronto.
UNITED STATES: Meccano Co. Inc., Elizabeth Av., Elizabeth, N.J. Meccano Co. Inc., 200, Fifth Avenue, New York.
AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Models Ltd., Kingston & Federal Streets, Auckland.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
INDIA: Karachi: Bombay Sports Depot, Elphinstone Street, Bombay; Bombay Sports Depot, Dhobi Talao. Calcutta: Bombay Sports Depot, 13/C, Old Court House Street.

The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

Mystery Photograph No. 14

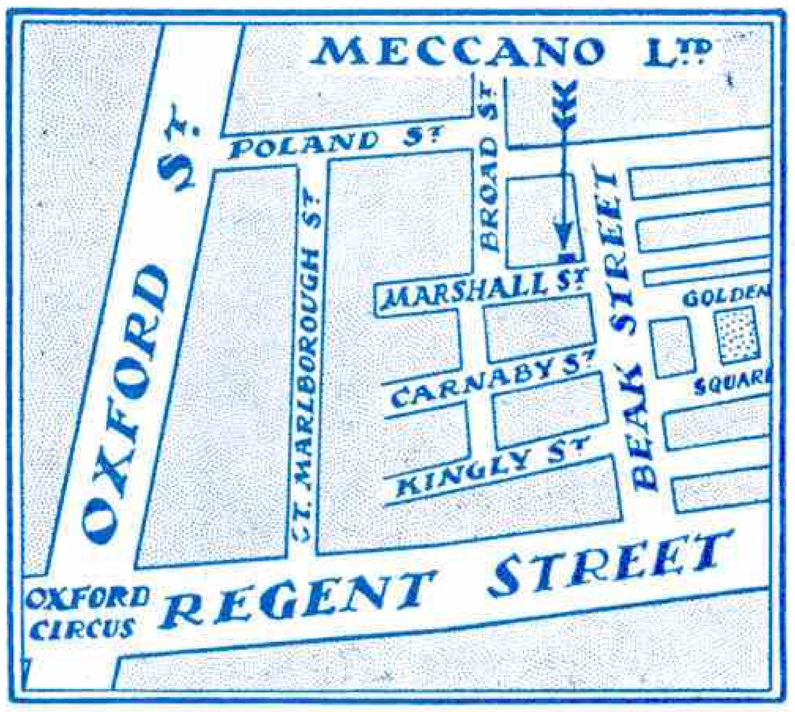
The "solutions" to the Mystery Photograph published in the January "*M.M.*" were chiefly remarkable for their astonishing variety. Many quaint and curious suggestions were made by competitors, but only a few readers hit upon the correct solution—a box of ball bearings seen from above. The first correct entry was received from P. H. Pettifor, 44, Hardy Road, Blackheath, London, S.E.3, to whom an autographed copy of the Editor's book "*Wonders of Engineering*" has been sent.

Our London Repair Depot

is at

5-6 Marshall Street • Golden Square • London W.1

Hitherto our Service Department at Liverpool has carried out all Hornby Train and Meccano Motor repairs for the whole of the United Kingdom. Now, for the convenience of boys living in London and the Home Counties, we have established a new London Service and Repair depot, fully equipped to deal expeditiously with all Hornby and Meccano repairs. The accompanying map shows how to find the depot, the address of which is 5-6, Marshall Street, Golden Square, W.1. In some cases it is possible to carry out repairs in an hour or two, but this is dependent entirely on the amount of work necessary.



Plan showing Position of our London Repair Depot.

When locomotives are sent to the depot by parcel post they should be packed carefully and addressed to Meccano Ltd., 5-6, Marshall Street, Golden Square, London, W.1. A note should be enclosed in the parcel giving the name and address of the sender, together with full instructions regarding the repairs to be carried out.

A list of charges for repairs to Hornby Locomotives and Meccano Motors is given below.

REPAIRS PRICE LIST

Hornby Clockwork Locomotives

New Parts Fitted, and Renovations	M1/2	M3	No. 0	No. 1	No. 1 Tank	No. 2	No. 2 Tank	No. 3
Gear Wheels								
No. 1 Gear Wheel	—	2/11	2/11	2/11	2/11	3/7	3/7	3/7
Nos. 1 and 2 Gear Wheels	—	3/2	3/2	3/2	3/2	3/11	3/11	4/–
Nos. 1, 2 and 3 Gear Wheels	—	3/4	3/4	3/4	3/4	4/3	4/3	4/4
Nos. 1, 2, 3 and 4 Gear Wheels	—	3/6	3/6	3/6	3/6	4/6	4/6	4/7
No. 2 Gear Wheel	—	2/6	2/6	2/6	2/6	3/2	3/2	3/3
Nos. 2 and 3 Gear Wheels	—	2/8	2/8	2/8	2/8	3/6	3/6	3/7
Nos. 2, 3 and 4 Gear Wheels	—	2/10	2/10	2/10	2/10	3/9	3/9	3/10
No. 2 Gear and Reversing Pinion	—	—	—	2/8	2/8	3/4	3/4	3/5
No. 3 Gear Wheel	—	2/5	2/5	2/5	2/5	3/2	3/2	3/2
Nos. 3 and 4 Gear Wheels	—	2/7	2/7	2/7	2/7	3/5	3/5	3/5
Housings								
*New Housings	1/9	2/6	3/6	4/–	4/–	6/6	7/–	11/–
Enamelling Housings	—	—	3/1	3/4	3/4	5/–	5/8	7/4
Additional charges for enamelling Housings in cases where repairs are also effected	—	—	1/10	2/1	2/1	3/8	4/4	6/–
Miscellaneous								
Mainspring	–/11	1/7	1/7	1/7	1/7	1/10	1/10	2/–
Set of Motor Wheels	—	1/8	1/8	1/8	1/8	2/3	2/3	2/3
Winding Shaft	—	2/4	2/4	2/4	2/4	2/11	2/11	2/11
4 Bogie Wheels	—	—	—	—	—	1/5	1/5	1/5
Governor	—	2/5	2/5	2/5	2/5	3/2	3/2	3/2

*In cases where new housings are fitted in addition to extensive mechanical repairs they will be charged at a reduced rate.

Meccano Clockwork Motor

New Parts Fitted	Clockwork Motor
Gear Wheels	
No. 1 Gear Wheel	1/10
Nos. 1 and 2 Gear Wheels	2/–
Nos. 1, 2 and 3 Gear Wheels	2/2
Nos. 1, 2, 3 and 4 Gear Wheels	2/4
No. 2 Gear Wheel	1/3
Nos. 2 and 3 Gear Wheels	1/5
Nos. 2, 3 and 4 Gear Wheels	1/7
No. 2 Gear and Reversing Pinion	1/4
No. 3 Gear Wheel	1/3
Nos. 3 and 4 Gear Wheels	1/5
Miscellaneous	
Mainspring	1/7
Winding Shaft	1/2
Governor	1/5
Re-assembling only	1/–

Hornby Electric Locomotives

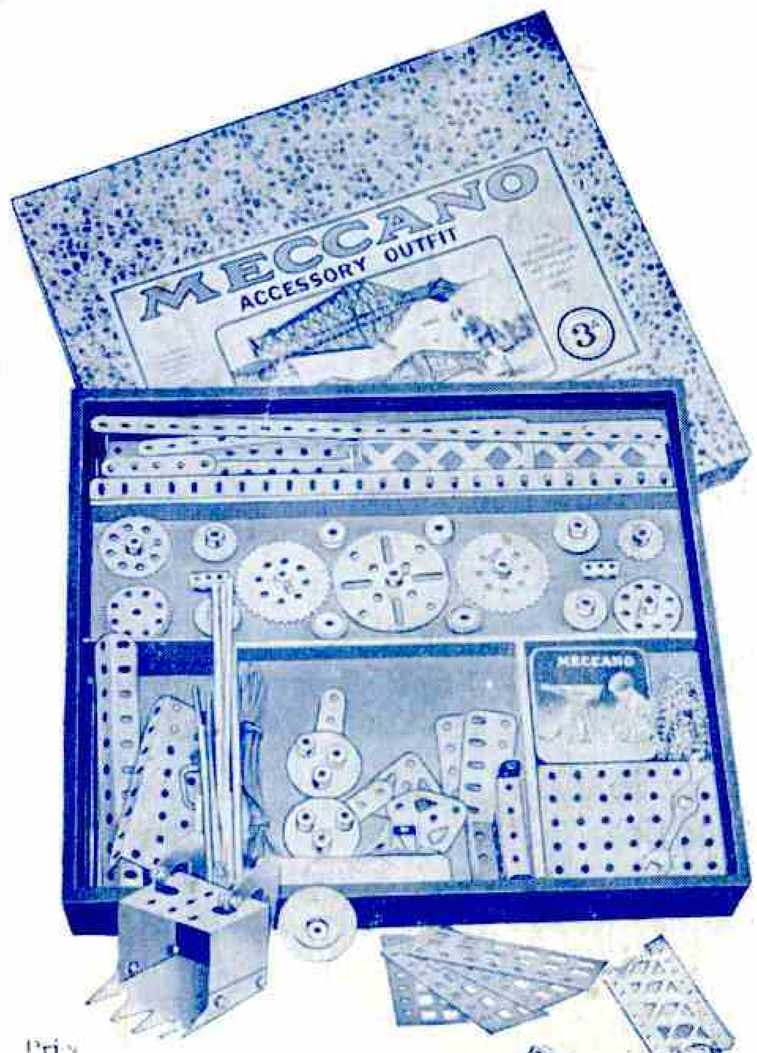
New Parts Fitted	Low-volt Locomotives	High-volt Locomotives
Brushes (2), Springs (2)	2/–	1/11
Brushes, Springs and Commutator	4/1	4/5
Brushes, Springs and Shoes	3/11	3/10
Brushes, Springs, Shoes and Commutator	4/3	4/7
Armature	5/8	6/1
Armature, Brushes, Springs	6/4	6/8
Armature, Brushes, Springs, Shoes	6/6	6/10
Field Coil	4/6	4/10
Sideplates (2)	5/7	4/5
Sideplates, Brushes and Springs	6/3	5/–
Sideplates, Brushes, Springs and Shoes	6/5	5/2
Collector Shoe Complete	3/10	3/10

Meccano Electric Motors

New Parts Fitted	Low-volt Motor No. 1	High-volt Electric Motor No. 2
Brushes (2), Springs (2)	1/9	1/9
Brushes, Springs and Commutator	3/3	3/7
Armature	3/7	6/11
Armature, Brushes, Springs	4/2	7/6
Field Coil	3/5	3/9
Sideplates (2)	2/8	2/8
Sideplates, Brushes and Springs	3/3	3/3

MECCANO LIMITED
Old Swan
LIVERPOOL

With an Accessory Outfit you can build more models — bigger + better!



Meccano Accessory Outfits connect the main Outfits from No. 00 to No. 7 and may be aptly described as the stepping stones to bigger and better models. A No. 00 Outfit may be converted into a No. 0 by adding to it a No. 00A Accessory Outfit and a No. 0A would then convert it into a No. 1. In this way, no matter with which Outfit you commence, you may build it up by degrees until you possess all the parts contained in the largest Meccano Outfit.

Prices of Meccano Accessory Outfits

		Price
No. 00A	(converts a No. 00 Outfit into a No. 0)	1/6
„ 0A	(„ „ 0 „ „ „ 1)	5/6
„ 1A	(„ „ 1 „ „ „ 2)	7/–
„ 2A	(„ „ 2 „ „ „ 3)	12/6
„ 3A	(„ „ 3 „ „ „ 4)	23/6

		Price
No. 4A	(converts a No. 4 Outfit into a No. 5)*	15/–
„ 5A*	(„ „ 5* „ „ „ 6)*	50/–
„ 5A†	(„ „ 5† „ „ „ 6)†	80/–
„ 6A†	(„ „ 6† „ „ „ 7†	215/–

*Carton. †Wood.

Special Inventor's Outfit Price 17/6

Your Meccano dealer carries stocks of Meccano Accessory Outfits. He will be happy to give you any further information you may require.

MECCANO

Special Inventor's Outfit

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PUBLISHED BY MECCANO LTD., OLD SWAN, LIVERPOOL, ENGLAND.
Printed by John Waddington Ltd., Leeds: and London.